Better Homes and Gardens®

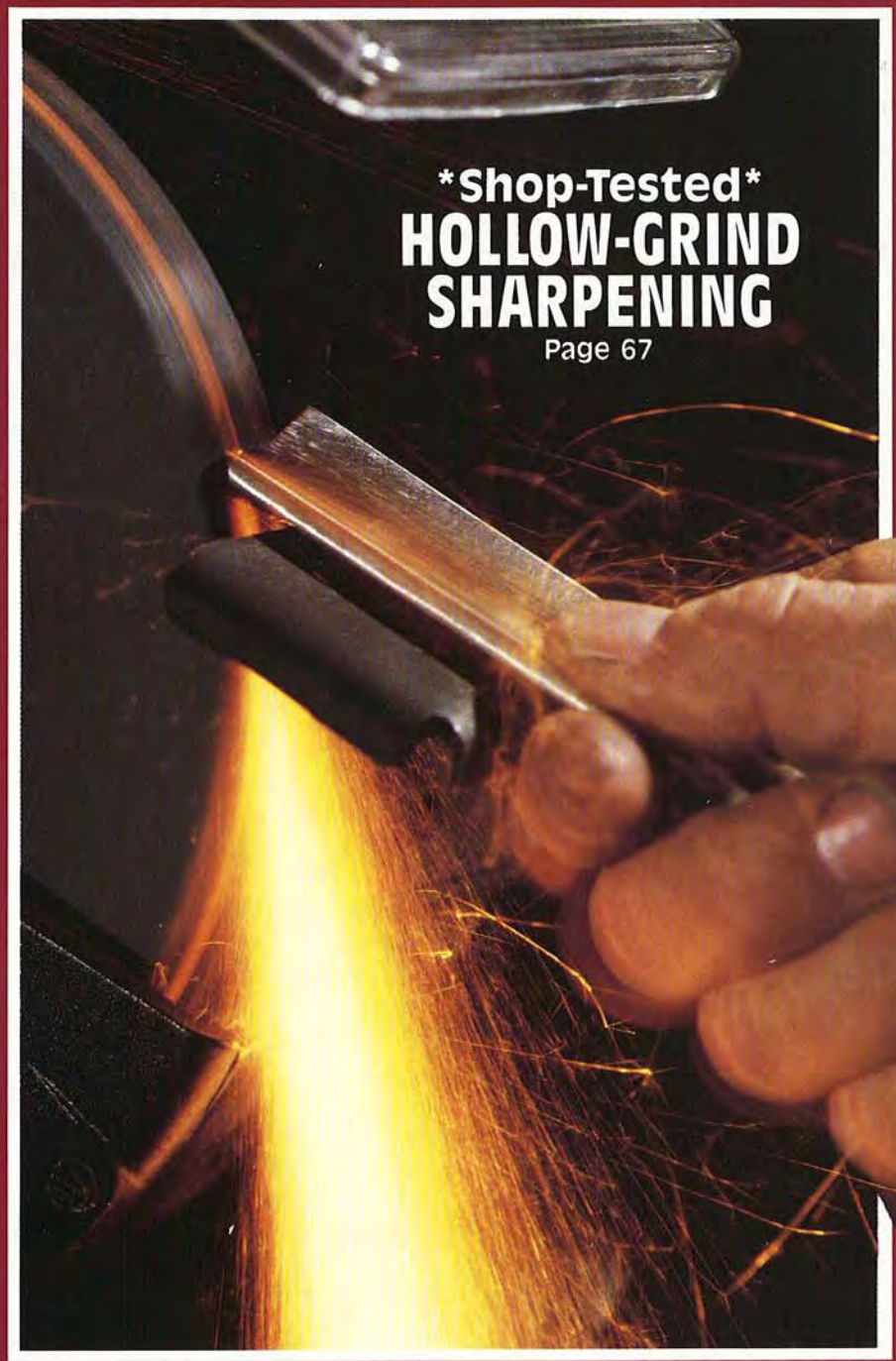
WOOD

THE MAGAZINE FOR HOME WOODWORKERS

$3.50

JUNE 1986 • ISSUE NO. 11
Display Until June 17

- **CORDLESS DRILLS AND SCREWDRIVERS**
  Do they perform?
  Comparison chart
- **WOODWORKERS' STANDARDS**
  Wood screws: When to use which type
  Shop reference chart
- **TIMBER CRUISING**
  Sizing up hardwood on the stump
- **DRILL BITS**
  How to choose the right one for the job
- **EXTRA-SPECIAL PROJECTS**
  Play structure
  Portable party wagon
  Domino set
  Custom miter box
  Weed pots



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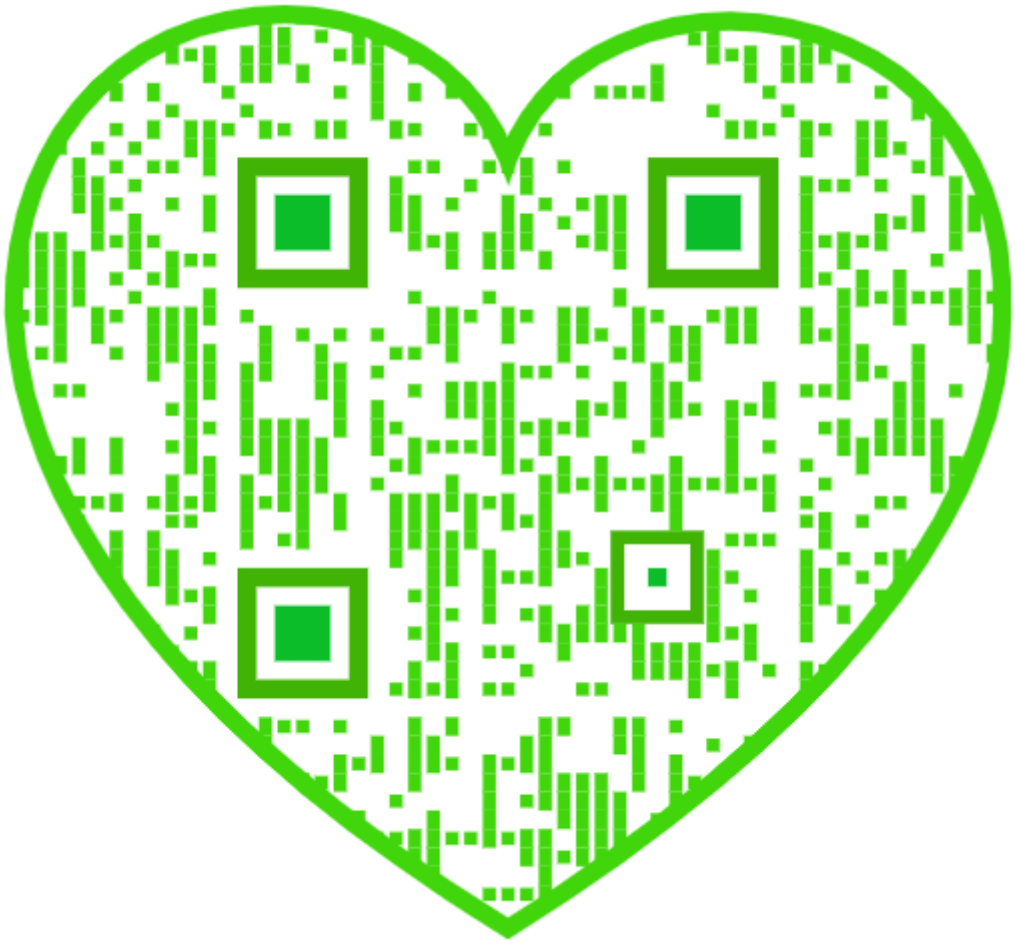

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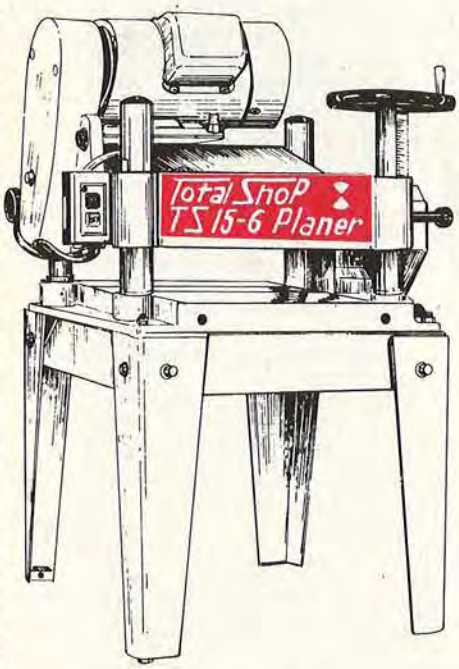

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In the two years we've been marketing the Paralok Fence nationwide, we haven't talked to one customer who doesn't agree.

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Both the front and rear lock. Two hefty locks, each with 750 pounds clamping pressure, independently lock the fence to the front and rear rails without squeezing the rails together. No distortion at the rear, no kickbacks due to binding the material.

Owners tell us.

"I'm a believer, I've had the Paralok on for a week now and we won't part company. The action is smooth, the parallelness is absolutely dead on, and it locks with a commitment to purpose that should be an inspiration to us all." *G. B. Lee Baker, Redmond, Oregon*

"The Fence is incredibly accurate... It has cut the time of any saw work by a measureable amount... I wish we had gotten this fence about four years ago." *Bill Tongate, shop supervisor, Valley Cabinet & Trim, Ridgecrest, California.*

More features.

The Paralok is easy to install, taking about 1½ hours or less. (It can also be mounted with an auxilliary fence.) The Paralok is easy to remove for cross-cuts. It gives you long infeed and outfeed for better control. The fence is always perfectly parallel, even when being reset for the next cut. The anodized aluminimum finish is tough, wear resistant and looks great. Because of such a smooth finish, material *glides* right through.

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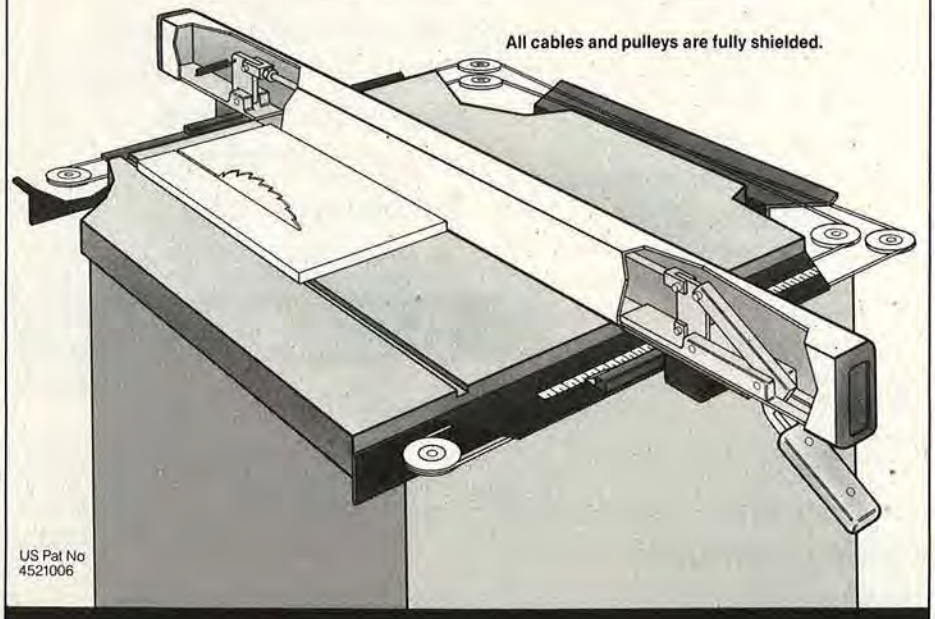

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WOOD
THE MAGAZINE FOR HOME WOODWORKERS

June 1986 • Vol. 3, No. 3 • Issue No. 11

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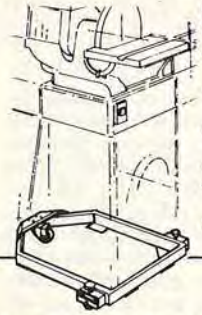

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WOOD

THE MAGAZINE FOR HOME WOODWORKERS

JUNE 1986 **ISSUE NO. 11**

WOOD PROFILE

PONDEROSA PINE: THE WEST'S TALL, LEAN, AND RUGGED SOFTWOOD 27

Knotty pine paneling and furnishings for the popular country look are two of the products that come from this legendary western wood.

CRAFTSMAN CLOSE-UP

MANY HAPPY RETURNS! BOOMERANGS BY CHET SNOUFFER 28

Chet Snouffer makes and sells boomerangs. He also throws them—well enough to win the 1985 world championships. Here are the fascinating secrets Chet has learned, plus a full-sized boomerang pattern.

OUTDOOR FURNITURE PROJECT

COME 'N' GET IT! PORTABLE PATIO PARTY WAGON 32

This versatile redwood serving cart makes the perfect companion to the stylish chairs featured in the June, 1985, issue of *WOOD*.

TOOL BUYMANSHIP

CHAAARGE! DRIVERS AND DRILLS YOU CAN USE JUST ABOUT ANYWHERE 38

Space-Age cordless tools really make the going easy when corded equipment is too awkward or dangerous to use. Here's a buying guide.

ANYONE FOR DOMINOES? 44

It's great fun—especially when you can say you made the set yourself. Follow our instructions to make this handsome set complete with carrying case.

WOODWORKERS' STANDARDS: SCREWS 46

Determining which screw to use for what project can be confusing. You'll want to keep this article and chart close at hand in the shop.

TIMBER CRUISING: HOW THE PROS SIZE UP FINE HARDWOOD ON THE STUMP 50

Ever wonder what furniture- and cabinet-quality hardwood lumber and veneer look like in the woods? Take a hike through the hardwoods with Features Editor Peter J. Stephano and find out.

BUYMANSHIP BASICS

POWER DRILL BITS & BORING TOOLS 54

For every hole you want to make, you have a choice of several bits or boring tools to do the job. Here's a handy chart to help you choose the right one.

HOMEMADE TOOL

TRIED & TRUE MITER BOX 56

By making the critical cuts for this project on the table saw before assembly, you guarantee that your miter box will deliver power-tool precison when you hand-cut small parts.

DOES FLECTO'S NEW ONE-DAY FINISHING SYSTEM REALLY WORK? WE JUST HAD TO FIND OUT! 58

You never know till you try it for yourself. Here's what we found when we tested the new Varathane system in our shop.

JUST FOR KIDS

FUN FOR ALL! KIDS' PLAY STRUCTURE 60

Wouldn't it be great to turn the youngsters loose in this backyard play structure? We guarantee they'll love it—and you for building it!

SHOP-TESTED TECHNIQUES

HOLLOW-GRIND SHARPENING 67

We put a lot of miles on our cutting tools in the *WOOD* workshop, and we sharpen most of our tools ourselves. You can, too, using the hollow-grinding and honing techniques explained here.

SCRAPWOOD SPECIAL: WEED POTS 74

You'll hear lots of compliments on these quick-to-make eye-catchers. And the materials come straight from the scrap bin.

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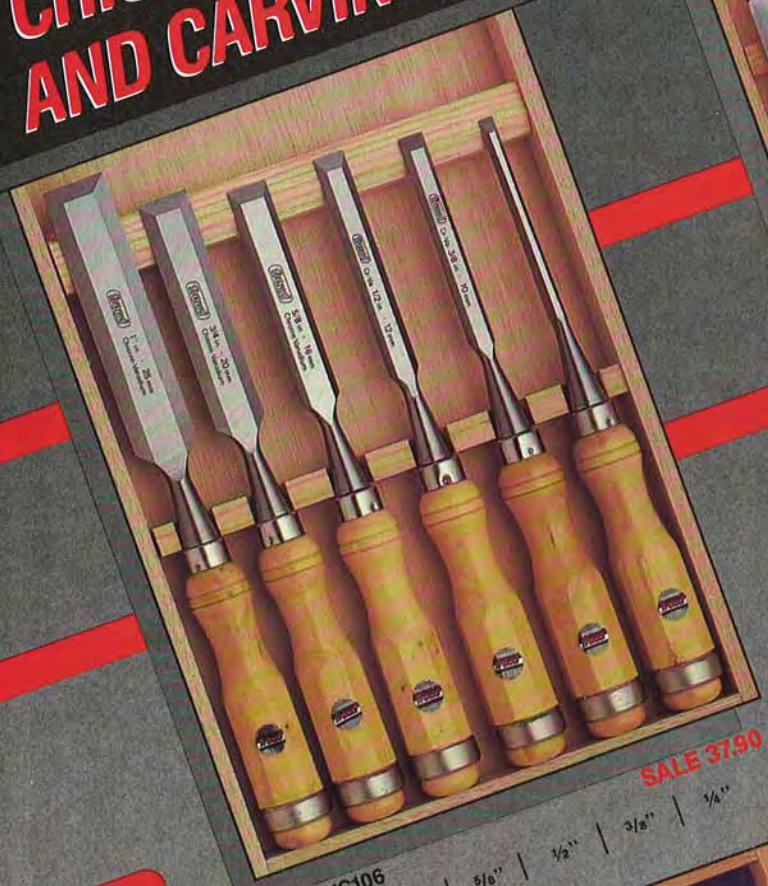

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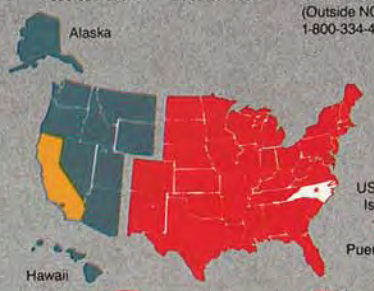

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THE EDITOR'S ANGLE

THE DOOR'S STILL OPEN, HERB!

By now, you're probably tired of hearing about Herb, the only guy in the United States who, according to the folks at Burger King®, has never had a Whopper™ sandwich. But this highly successful promotional campaign does prove that the public often responds with good humor and enthusiasm when someone asks them to do something—in this case to help find a total societal dropout by the name of Herb.

All this is a rather long-winded maneuver on my part to get around to saying Thank You for taking me up on my offer to visit us here at the *WOOD* Magazine offices. Were I a little faster of foot, I would have had the good sense to keep a log of the names of those of you who dropped in to chat and look around. But I've missed that opportunity.

What the rest of the staff and I did take advantage of is the time we were able to spend with you. We learned a lot more about the type of people you are, and hopefully you went away with the feeling that we really do care a great deal about the readers of this magazine.

I would guess that we probably gave tours to 200 or so of you, and let me assure you that it was entirely our pleasure. But like they say in the Burger King commercials, we know there are still a few more of you out there who haven't dropped by yet. So if you happen to be passing through Des Moines on your way here or there, I'm here to say that the coffeepot is still plugged in, and that we've got a Styrofoam® cup waiting here with your name on it.

Larry Clayton

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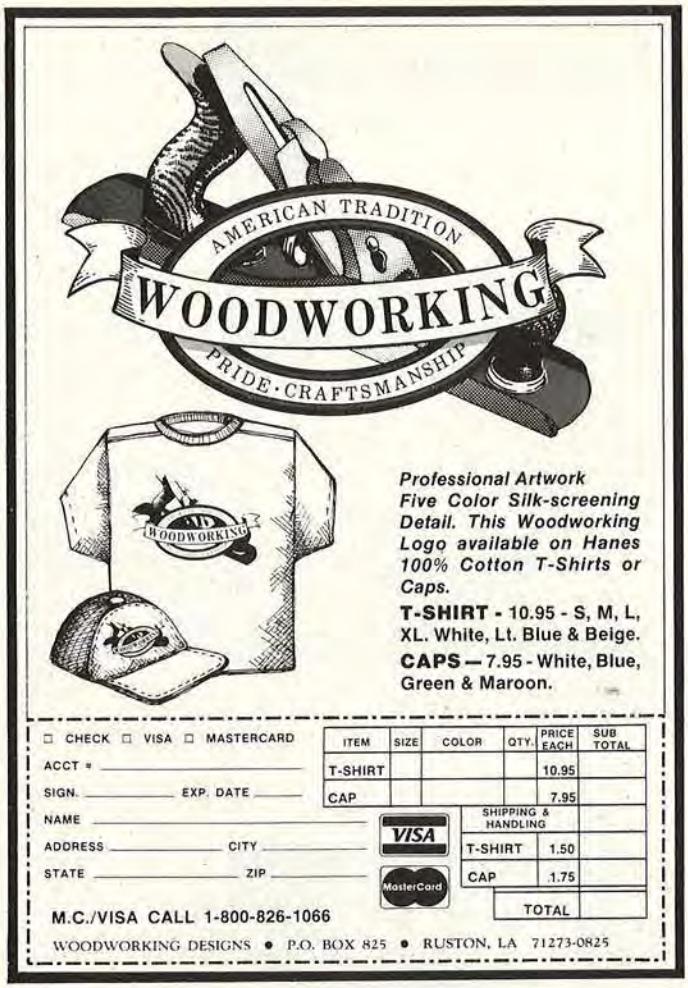

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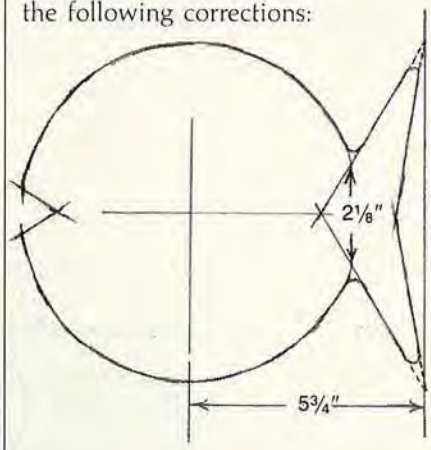
TALKING BACK

Print this article

We welcome comments, criticisms, suggestions . . . even an occasional compliment. The volume of mail we receive makes it impossible to answer every letter, but we promise to do our level best. Send your correspondence to: Letters Editor, *WOOD* Magazine, Locust at 17th, Des Moines, IA 50336.

FISH STORY

Bud Horner of Des Moines, Iowa, gets this month's Eagle-Eye Award for spotting two inconsistencies in a drawing on p. 82 of the February, 1986, issue of *WOOD*. Please note the following corrections:



AS THE WORLD TURNS

It's apparent that woodturner Bert Thompson captivated the imagination of many of our readers (*WOOD*, February, 1986, p. 36). For those of you who want to learn more about Bert's small woodturning classes, contact him at 1069 Southdown Rd., Mississauga, ON L5J 2Y1, Canada (phone: 416-823-5937).

NEW VIDEOS FROM WANA

Since we compiled our guide to woodworking videos (*WOOD*, April, 1986, p. 90), the Woodworking Association of North America (WANA) has released three cassettes: "Router Basics," "Table Mounting Your Router," and "Router Jigs and Accessories." The videos feature router authority Bob Rosendahl, and cost $39.95 each. Order from WANA, P.O. Box 706, Plymouth, NH 03264.

WATCH THAT WHEEL

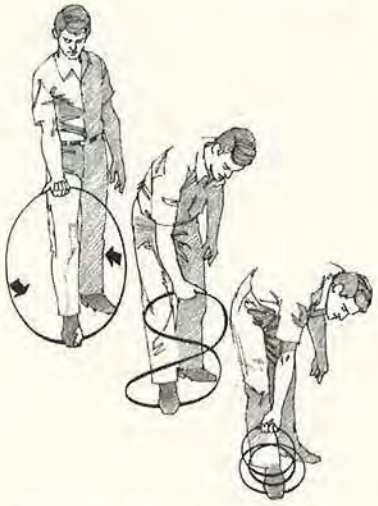
(Regarding the wet-sharpening attachment for the Multi-Machine featured on p. 40 of the February, 1986 issue of *WOOD*): If you let the wheel stand in the pan of water very long, you might have a surprise when you turned the wheel on. It could be out of balance and could blow to pieces.

—Glen Scott, Rancho Cordova, Calif.

Thanks for writing, Glen. Because the wheel used with the wet-sharpening attachment turns at only 172 rpm, there shouldn't be any danger. However, we definitely advise readers to remove the water tray and wheel before attempting any higher-speed operations.

BAND-SAW BLADES: ROUND TWO

We got a fistfull of letters from readers who shared *their* method for folding a band-saw blade (*WOOD*, February, 1986, p. 14). Here's how one of them, Werner Zinn of Orlando, Fla., described it:



Hold the blade in front of you with one hand. Put your foot inside the loop and step on the blade, clamping it firmly to the floor. Simultaneously rotate and lower your hand as you hold the top of the blade. By the time your hand makes ¾ to one full revolution, the blade will have popped into three coils. (P.S. It's a good idea to keep the teeth pointing away from you.)

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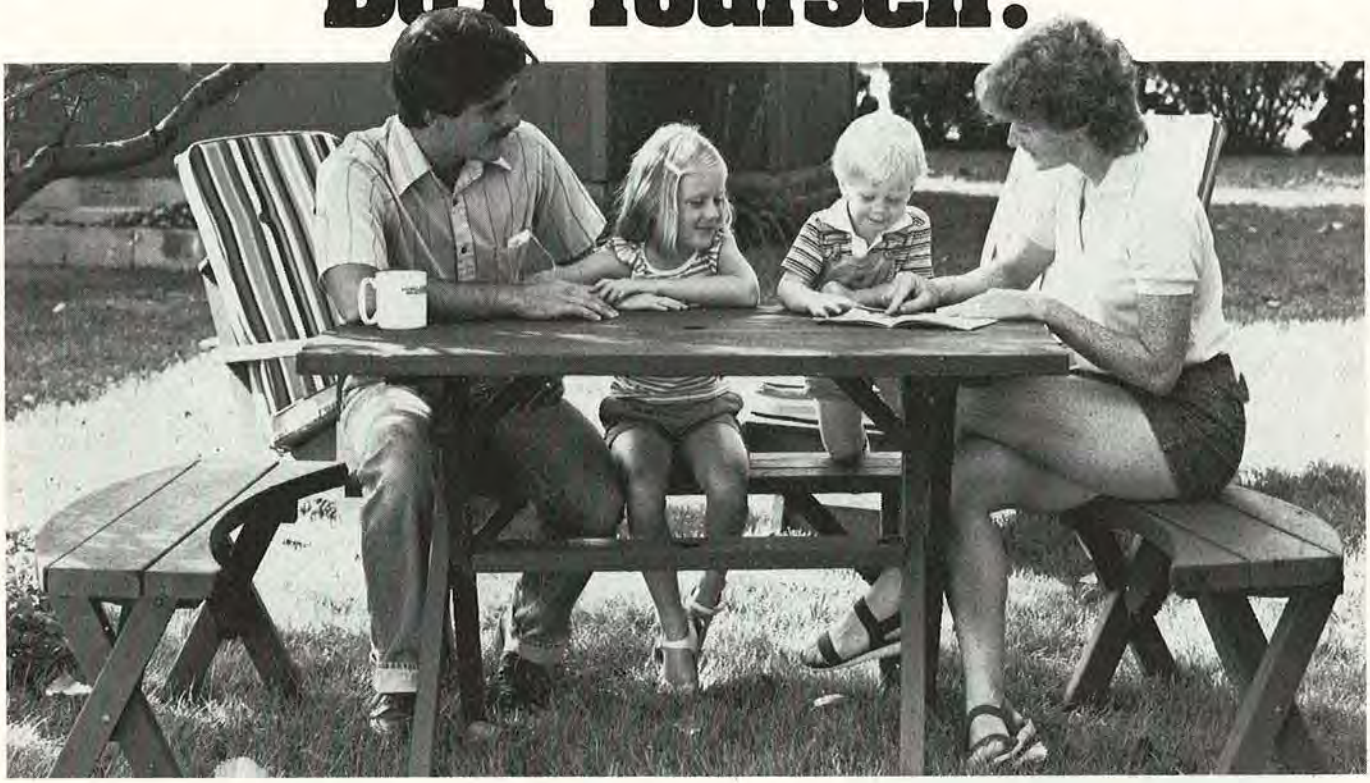

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TIPS FROM YOUR SHOP (AND OURS)

Print this article

In woodworking, as in life, no one knows it all. But through experience, we all discover—or stumble onto—better, safer, faster, or easier ways to do things. When we devise interesting tips or techniques, we'll share them with you in this column. And when you send us your favorites, we'll pay you $25 for each submission we publish. No shop tips can be returned. Mail your tips to:

Shop Tips
Better Homes and Gardens®
***WOOD* Magazine**
Locust at 17th
Des Moines, IA 50336

A finishing record you'll never misplace

You've been successful with a lot of finishing techniques and products, but the combination of finishes used on an individual piece of furniture often escapes your mind. What was it that you used on that great-looking cherry table or oak chair?

TIP: If you sample many different products, it's especially important to note your comments right on the project. Before finishing (or refinishing), apply peel-and-stick labels or glue paper to an inconspicuous area of the project. Note the date and any important facts about how you did it. The finish you apply over the paper will guarantee that you can refer to your notes in the future.

—Ralph Briggs, Baraboo, Wis.

Super scraper solution

When scraping wood near the edge of plastic laminates, the scraper accidentally skips across the laminate and does irreparable damage to the new surface.

TIP: Hold a handscrew firmly against the edge trim. Position the scraper in the handscrew as close as possible to the plastic laminate. Tighten the clamp and dress down the surface while the clamp guides the scraper.

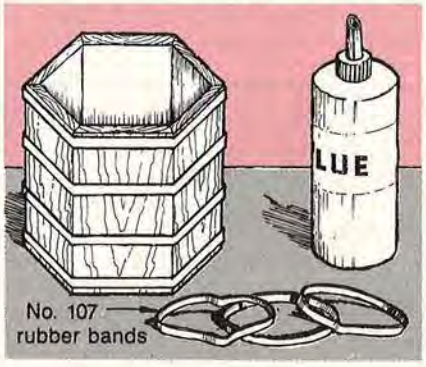
—Kim Downing, Des Moines, Iowa

The original "band" clamp

Although it's fairly routine to glue flat surfaces, you find it difficult to get even pressure on round, contoured, irregular, or otherwise out-of-the-ordinary surfaces.

TIP: For less than $2 at most office supply stores, you can purchase an ordinary ½-lb. box of no. 107 rubber bands. The bands, which measure 1/16" thick, 5/8" wide, and 7" long before stretching, make great clamps. Smaller bands also can be useful in the shop. The glue pops off easily, and they never rust. (By the way, the bands will last a lot longer if you store them in a cool, dark drawer.)

—Mike Locke, Long Beach, Calif.

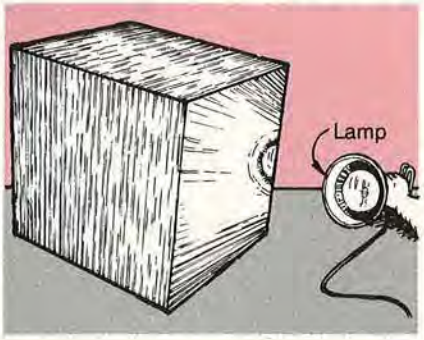


See the light and make finishing easier

Despite paying careful attention, it's easy to overlook an area when you apply finish coats with a brush or sprayer.

TIP: Use a table lamp or some type of a portable lighting unit to inspect the finish while it's still wet. Viewed from approximately a 45° angle to the surface, the properly brushed or sprayed areas will glisten in the light. Dull areas indicate the spots where you need to add more finish.

—From the WOOD Shop

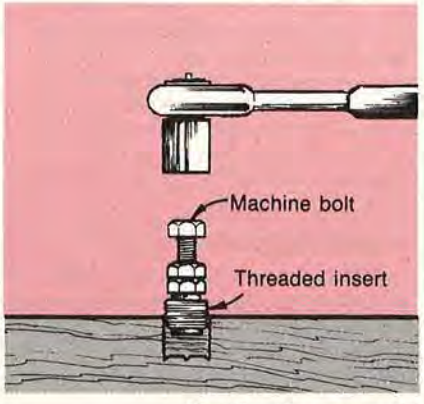


A thread in time

Threaded inserts make marvelous fasteners, but there just has to be an easier way to install them.

TIP: There is! Match a machine bolt to the size of the inner threads of the insert. Thread two nuts on the end of the bolt and tighten them against each other. Screw in the insert with a ratchet; then back out the machine bolt. (We found that a drill press works even better—Ed.)

—J. D. Atkinson, Pioneer, Calif.



Continued on page 16

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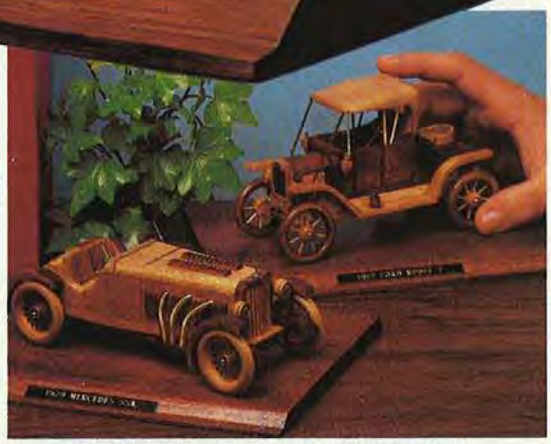

Each Vintage Car comes with hardwood base and brass name plate. Top: 1912 Ford Model T Touring Car. Bottom: 1929 Mercedes SSK Roadster.

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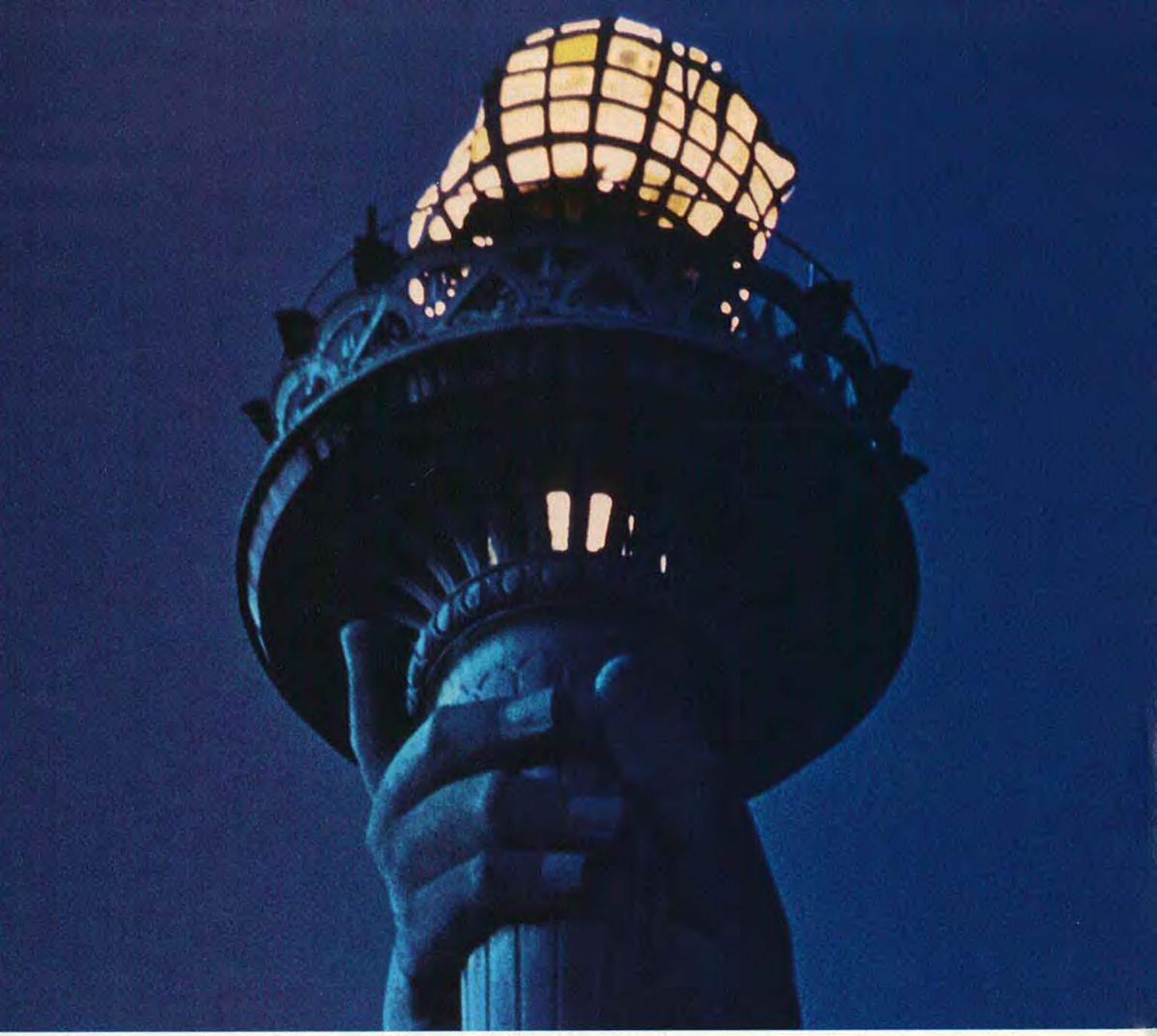

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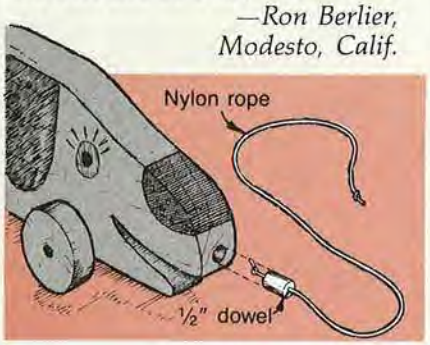
Continued from page 12

Knotty solution to a problem

It's difficult to avoid screw eyes when a toy needs a pull string. But you worry about tots swallowing such small parts.

TIP: A ½" dowel and a piece of nylon rope make a good replacement for a screw eye. Drill a ½" hole about 1" into the "nose" of the toy. Cut a 1½" length from the dowel and drill a ⅛"-diameter hole through the center. Slip a piece of ⅛" nylon rope through the hole and tie a knot at each end.

—Ron Berlier, Modesto, Calif.

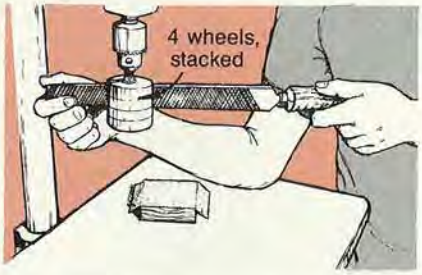


Spin balance in the shop

No matter how meticulous you are, the four wooden wheels you make in your shop each have their own characteristics and never perform as a set. How can you make them uniform?

TIP: Here's a solution: Use a hole saw to cut the wheels from your favorite stock. Slip a ¼" bolt through the center of the wheels and tighten with nuts at each end of the stack. Then, sand all the wheels at once.

—Stephen R. Garavatti, Salt Lake City, Utah



Save that carpet scrap for applying adhesive

You might as well throw away a brush after using it to spread contact cement on a project. It makes a hopeless cleanup job.

TIP: Don't waste your time or materials worrying about cleanup when working with contact cement. A clean scrap of carpet wrapped around a block of wood spreads the glue evenly. Best of all, you can throw it away after you use it.

—From the WOOD Shop

Continued on page 18

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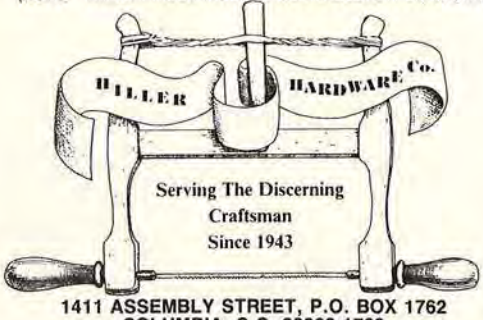

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TIPS FROM YOUR SHOP (AND OURS)

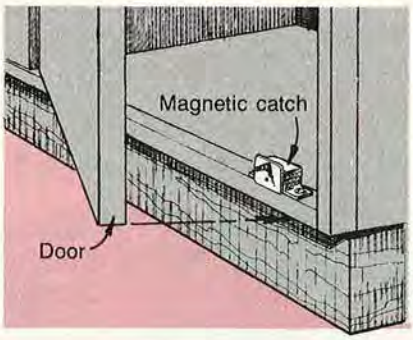
Continued from page 16

A magnetic idea—with a catch

The challenge of installing magnetic catches lies in aligning the strike plate with the magnet.

TIP: First, install the magnet on the cabinet frame. Put the wood screw through the strike plate and place it on the magnet. Close the door and the screw will punch the location hole onto the door. After installation, adjust the hardware as necessary.

—From the WOOD Shop

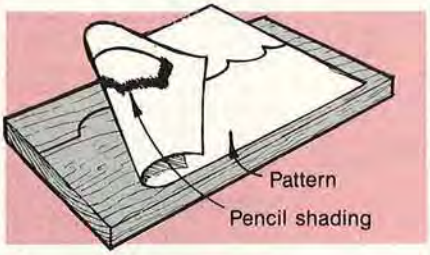


An alternative way to trace a pattern

Carbon paper can be hard to come by when you need it. Also, it's often awkward to use.

TIP: With a no. 2 or softer lead pencil, copy your own pattern without carbon paper. On the back side of the pattern, rub the pencil over *only* the portions you will transfer. If the pattern is one that you will frequently transfer, you can quickly freshen the back side with a pencil.

—Ray Dobelstein, Flemington, N.J.



Another use for those plastic jugs

Epoxy is a great adhesive, but the glue left in the mixing container is next to impossible to remove.

TIP: The versatile one-gallon milk jug comes to the rescue again. Cut out a section of the bottle and mix the glue in the container. When the leftover glue has cured, bend the flexible jug and you'll be able to pop out the residue.

—From the WOOD Shop

Nice to look at; nice to use

Besides working well for marking dovetails and mortise and tenon joints, the three tools in this rosewood-and-brass set are just plain nice to look at. The marking gauge has an adjustable pull slide for fast layout of mortises, and the 6" square has a blued steel blade that's triple-pinned to the handle. The blade on the 9" sliding bevel stores in its handle and holds any angle with its brass wing nut. *Marking Set, $29.95 postpaid from Woodcraft Supply Corp., 41 Atlantic Avenue, P.O. Box 4000—Dept. WBH56B, Woburn, MA 01888.*

This glue won't finish before you do

Some clear hot melt glues set up so quickly you run the risk of not getting project pieces positioned exactly where you want them. But these yellow glue sticks give you a second chance: The glue's 90- to 120-second drying time lets you shift pieces after they're in place. *Black & Decker Wood/Repair Hot Melt Glue Sticks: 2" (12/pack), $2.85; 2" (48/pack), $6.30; 4" (6/pack), $2.85; 4" (24/pack), $6.30. Available nationwide through hardware stores and home centers.*

What's the angle?

Eliminate time-consuming hand measuring of blade angles on your table saw—and trial-and-error cutting of expensive stock—with this unique electronic measuring tool. A small sensor attaches to the arm that adjusts your saw's blade angle; the sensor sends a signal (via flexible cable) to a digital display unit mounted anywhere on your saw's housing. *BladeFinder Angle Measuring Instrument, Biesemeyer Manufacturing, 216 S. Alma School Rd., Suite 3, Mesa, AZ 85202. For the dealer nearest you, call toll-free: 800-782-1831.*

Continued

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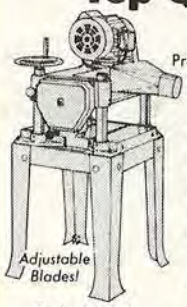

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$185 Order No. A0264-1360 Ship. Frt. Col.

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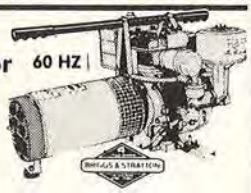

Now have electrical power anywhere,anytime! This power generator features: • 8 HP **Briggs & Stratton** engine. • 1-120 V duplex & 1-240 V duplex receptacles, 36.7/18.3 amps. • 5000 watts surge, 4400 watts continuous power. • Magnetron® solid-state ignition. • **NEW** rotary field design means no brushes to replace, ever! • Service centers nationwide. • Assembled in U.S. • Dimensions: 25"L x 17½"W x 17¾"H. • Wt: 116 lbs. • **Full 1 Year Parts Replacement Warranty!**

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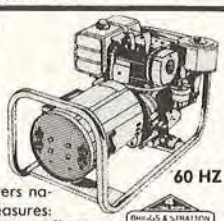

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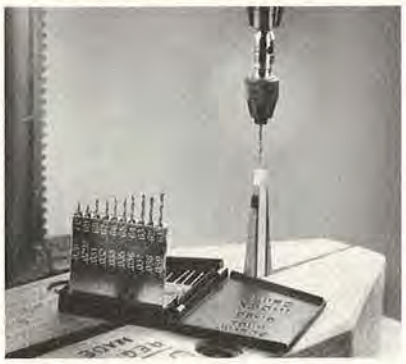

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At first glance, these probably look like standard drill bits. Check the picture closely, though—the entire 20-bit set and the adapter chuck are small enough to hide in the palm of your hand! Perfect for working on toys and other small projects, the bits range from #61 (.039″) to #80 (.0135″). *Micro-Size Drill Bits (#26104) and Adapter Chuck (#26107), $29.90 from Micro-Mark, 24 East Main Street, P.O. Box 5112-198, Clinton, NJ 08809.*

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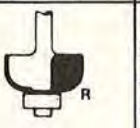		COVE				
	#01	1/4" R	1/4"	1"	1/2"	$13.00
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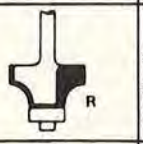		ROUND OVER				
	#04	1/4" R	1/4"	1"	1/2"	15.00
	#05	3/8" R	3/8"	1¼"	5/8"	16.00
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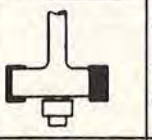
	#07	5/32" R	5/32"	1¼"	15/32"	18.00
	#08	1/4" R	1/4"	1½"	3/4"	20.00
	#11	3/8" RABBETING	Deep 3/8"	1¼"	1/2"	14.00
	#09	1/8" (KERF) SLOT CUTTER		1¼"	1/8"	14.00
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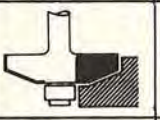
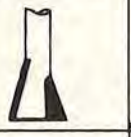
	#15	RAISED PANEL	20° Angle	1-5/8"	1/2"	25.00
		DOVETAIL BITS				
	#16	3/8" DOVETAIL 9°		3/8"	3/8"	7.50
	#17	1/2" DOVETAIL 14°		1/2"	1/2"	8.50
	#18	3/4" DOVETAIL 14°		3/4"	7/8"	10.50
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	#23	3/4" GROOVING OGEE		3/4"	7/16"	21.00
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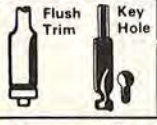
	#26	3/8" Straight Bit		3/8"	1"	7.00
	#27	1/2" Straight Bit		1/2"	1"	7.00
	#28	3/4" Straight Bit		3/4"	1"	10.50
 Flush Trim Key Hole	#13	1/2" FLUSH TRIM		1/2"	1"	8.50
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A TALE OF TWO

When ships crossed the oceans by force of winds, two brothers sailed to the new America to seek their fortune. Both believed in the value of hard work and diligence, and both chose to follow the chairmaker's trade. One, however, remained in the city; the other continued west into the mountains.

The brother in the mountains soon found a teacher—an old country chairmaker in need of help. The aged mentor taught him how to find the straight-grained hickory in the forest, and how to fell it.

In his work yard, the country chairmaker instructed the young man in the proper splitting of the log into billets. From the billets came the rounds for frames and spreaders, thin slats for backs, and square-rivved stock for rockers, all by hand axe and spokeshave.

His city brother, having found a master of his own, signed his papers of apprenticeship. His education began at the docks haggling the price of mahogany logs. Next came the negotiation with the carters who would haul the timbers up to the saw yard. In the competitive hustle of the city shop, the young apprentice made a place for himself.

Chair backs for function and fashion

Far from those noisy streets, the country brother attended to the bending of the splats for chairbacks. Under the old man's guidance, the still-green wood was forced into the work-worn bending frames where it would remain for weeks.

City brother helped shape the backs of chairs as well. He pulled his end of a narrow-bladed frame saw to track the curves struck by the master's graphite pencil. The master laid out the cutting patterns on the costly planks so that they meshed like spoons in a drawer.

Although both masters would leave the actual sawing and chiseling to the younger men, they personally marked out the joints for each of their chairs. For the rockers and utilitarian seating of the mountains, the country chairmaker wielded a gauge made of iron nails set into a hickory staff. For the ornate parlor and dining chairs of the carriage trade, the city chairmaker used one of rosewood, brass, and steel. Their gauges were different, but their precision the same.

Joinery to endure through the years

The mortise and tenon joints cut by the city chairmaker and his country brother were the same in theory, but different in execution.

The city brother chopped exact pockets and sawed precisely matching mahogany tongues. These simple shapes were then driven together and locked in place with pegs and hide glue.

CHAIRMAKERS

Fashioned by the city chairmaker, a mahogany chair awaits upholstering.

Destined for a farmer's porch, the country rocker displays few city frills.

For the back of his rocking chair, the country brother used similar joinery. For the base of his chair, however, he used simple auger holes bored into the uprights. The tenons on his stretcher ends he cut with a common pocket knife.

Superficially simple, these country joints were actually far more complex than the glued joints of any city chair. Rather than shaping plain cylindrical tenons, the country chairmaker quickly but carefully whittled the ends of each stretcher to an oval swelling. These dry, bulbous ends, when driven into the less-seasoned uprights, would soon be locked in place by the death grip of the shrinking wood surrounding them. There was no need for glue.

Chairs with different destinies

Although his chair was not yet complete, the city brother was now done with his part of the work. He was learning only the trade of the chair framer. The strong mahogany frame he built now went to the carver and his apprentices, who would in turn send it to the finishers. Then, it would be passed along to the upholsterer for the leather seat.

Back in the mountains, the country brother was not yet finished. In the woods he felled a small hickory tree and pulled its bark off in long heavy strips to coil around his hand. In the shop, he shaved the bark thinner and to a consistent width to weave a herringbone pattern for the rocker's seat. "Over two, under two," he counted to himself as his fingers worked the yet-pliable strips.

The seat, still rough-looking and fuzzy when he finished it, would acquire the ultimate polish from its new owner in his first year of sitting and rocking.

From the beginning, the two chairs had different destinies, just as their makers did. The hickory rocker was bound for the porch of a farmer's log house; the mahogany chair would join others like it at the dining table in a merchant's mansion. No one could mistake one chair for the other. But both chairs were precisely suited to the materials and skills available, and the wants and means of their prospective owners. And the two brothers, while far apart, were united by the fraternity of fine craftsmanship.

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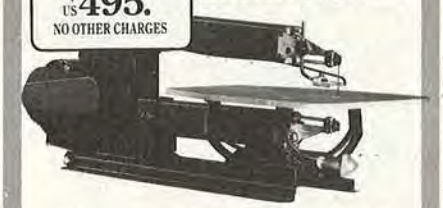

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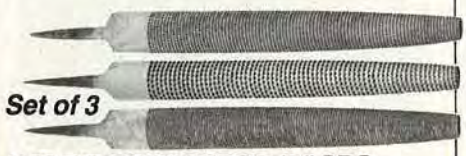

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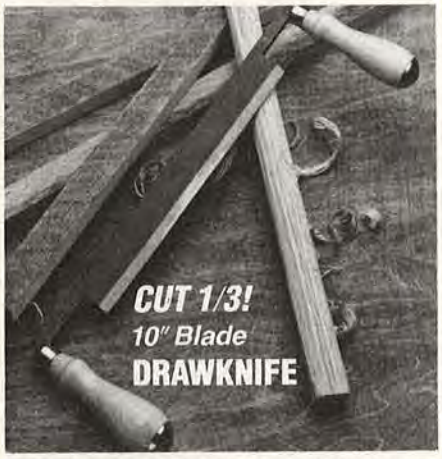

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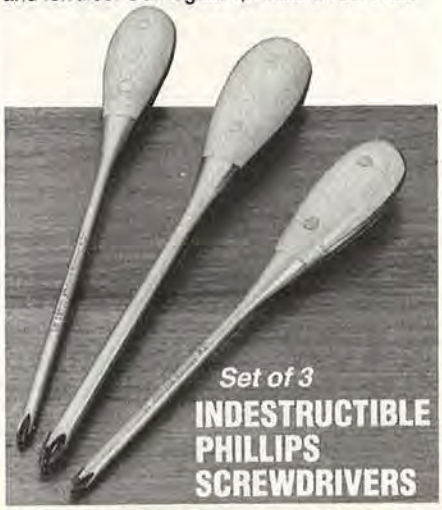

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B7100	3x24" dustless Belt Sand.	208	140
B7200A	4x24" dustless Belt Sand.	269	165
D100VR	3/8" VSR 0-1200 rpm drill	91	49
W740	7¼" 13 amp circular saw	158	99
JS60	8¼" 13 amp circular saw	171	109
JSE60	Jig Saw-Single Speed	172	99
R150	Jig Saw-electronic v/speed	198	123
R330	1 H.P. Plunge Router	138	86
R500	2 H.P. Router	220	138
E3800	3 H.P. Router	265	163
L120U	Drywall screwdriver 0-4000	126	79
	3⅝" Planer	142	89
BD1020R	3/8" 2-spd Cordless Drill w/free holster-Xtra special buy	148	95
TS251U	10" Mitre Box	300	169
SG1150C	4½" H.D. Mini-Grinder	99	59

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0244-1	½ drill 4.5A magnum	159	115
0222-1	3/8 drill 3.3A 0-100 rpm	146	99
0228-1	3/8 drill 3.3A 0-1000 rpm	129	92
0375-1	3/8 close quarter drill — NEW — 3.5 amp	175	118
0210-1	3/8 cordless drill — NEW — 2 speed	154	95
6539-1	cordless screwdriver — NEW — 190 RPM	84	59
1007-1	½" drill 4.5A D-Hdle	199	145
1107-1	½" drill 4.5A D-Hdle	204	145
3300-1	magnum rt angle drive kit	249	170
3102-1	Plmbrs rt angle drill kit	263	180
1676-1	HD Hole Hawg w/case 2 sp	333	235
5395	3/8 sgle sp hammer drill kt	203	150
5397	3/8 var sp hammer drill kit	208	155
5371-1	HD mag. hammer drill ½"	287	207
5373	HD mag. ham. drill 3/8"	240	175
6511	2 speed Sawzall w/case	181	122
6226	port band saw 2 sp w/case	382	280
6234	TSC band saw port w/case	382	280
6405	8¼" circ. saw 13 amp	179	127
6460	10¼" 15 amp w/case	349	245
6165	12" Chop saw 15 amp 4200 R.P.M.	285	189
6255	v/sp Jig Saw 3.8 amp	199	140
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LU73M010	Cut-Off	10"	60	79.65	36
LU82M010	Cut-Off	10"	60	86.40	44
LU84M010	Combination	10"	40	70.99	36
LU84M011	Combination	10"	50	74.51	37
LU85M010	Super Cut-Off	10"	80	110.88	62
LM72M010	Ripping	10"	24	64.85	34
DS 306	6" Dado			139.00	92
DS 308	8" Dado			170.00	105
TR 100	3 blades & Dado set			399.00	255

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4300DW	Jig Saw	158	99
5081DW	3⅜" Saw Kit	174	95
5600DW	6¼" Circular Saw	224	125
9035DW	Finishing Sander	128	73
6010DWK	3/8" Cordless Drill Kit	152	88
6010SDW	3/8" Cordless Drill	84	45
8400DW	3/8" Hammer Drill	188	105
DA3000DW	3/8" Angle Drill	176	98
6010DL	3/8" Drill w/Flashlight	162	89
6012HDW	3/8" 2 spd Driver Drill w/Bat & Metal Case	178	98
DK1002	3/8" Drill w/Flursnt Lt	164	90
6710DW	Cordless Screwdrvr Kit	148	84

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11-950	8" Bench Drill Press	124	100
28-160	10" Bench Band Saw	158	125
40-500	15" Scroll Saw	105	85
23-680	6" Grinder Bench	62	50
23-880	8" Grinder Bench	99	85

MAKITA TOOLS

		List	Sale
BO4510	Sander	79	43
9900B	3"x 21" belt sander	198	119
9924B	3"x 24" belt sander	189	130
9924DB	3"x 24" b/sand. w/bag	214	130
9035	⅓ sheet finish sander	79	48
9045B	½ sheet finish sander	156	90
9045N	¼ sht fin. sand. w/bag	158	105
4200N	4⅜ circ. saw 7.5 amp	152	93
5008NB	8¼ circ. saw 13 amp	178	105
5201NA	10¼ circ. saw 12 amp	348	215
4300BV	v/sp jig saw 3.5 amp	192	120
4301BV	orb v/sp jig saw 3.5 amp	208	125
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741071-5	6000 (fine) Grdg Whl	43	30
1900BW	3¼" planer w/case	154	192
1100HD	3¼" planer w/case	278	160
3608BK	¾ hp router w/case	132	85
3601B	1⅜ hp router	168	115
3700B	½ hp trimmer 28,000 rpm	124	82
BO4530	6" Round Sander	84	48
DA3000	3/8" angle drill	158	105
DP4700	½ v/sp w/rev" 4.8 amp	154	92
HP1030W	3/8 v.s.r. hammer drill w/case	145	98
6300LR	½" angle drill w/rev	229	152
84198B-2W	½" s sp. hammer drill w/case	238	150
GV5000	Disc Sander	79	53
6800DB	2500 rpm 3.5 amp	123	79
6800DBV	0-2500 rpm 3.5 amp	133	89
6801DB	4000 rpm 3.5 amp	123	79
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JV1600	var. speed jig saw	145	89
JV2000	var. speed orb. jig saw	165	100
5005BA	5½" circular saw 8 amp. with brake	154	98
9207SPC	7" var/speed electronic sander/polisher	209	130
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8975	H.D. heat Gun, 11.6A Low 570°F - High 1000°F	74	49
5920	belt sander 3x24 w/o bag	289	199
5925	belt sander 3x24 w/bag	309	215
5930	belt sander 4x24 w/o bag	299	209
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351	3" x21" Belt Sander	189	125
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691	1½ H.P. D-Hdle 8 amp	218	145
536	1½ H.P. Speedmatic Double Handle	300	190
537	1½ H.P. Speedmatic Double Handle	315	215
520	3 H.P. Production	460	270
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310	3.8 amp laminate trimmer	190	135
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DP3720	3/8 drill Rev. 0-1800 rpm	90	47
6510LVR	3/8 drill Rev. 0-1500 rpm	116	67
6013BR	½" Drill rev. 6 amp	174	100
5402A	16" Circular Saw-12 amp	468	315
2414	14" Cut Off Saw-13 amp	282	169
3612BR	3 HP Plunge Router	286	175
9401	4x24 belt Sander w/bag	248	160

PORTER-CABLE

		List	Sale
696	H.D. Shaper Table	150	105
695	H.D. 1½ hp Router/Shaper	278	190
399	Drywall Cut-Out Unit	100	70
736	V/Speed *Speedtronic* Band Saw	450	330
7564	½" X.H.D. Drill 8 amp	205	145

BOSCH TOOLS

		List	Sale
1581VS	Top Handle Jig Saw	225	126
1582VS	Barrel Grip Jig Saw	126	118
1604	1¾ H.P. Router	199	118
1942	Heat Gun 650°-900°	99	85
1272	3x24" Belt Sander	259	159
1272D	3x24" Belt Sander w/bag	274	169
1273	4x24" Belt Sander	274	169
1273D	4x24 Belt Sander w/bag	289	179

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		List	Sale
34-010	Motorized Mitre-Box	231	149

★ NEW LOW PRICES ★ PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
850	for ¾" Black Pipe	11.23	7.15	79.00
852	for ½" Black Pipe	9.36	6.10	67.50

JORGENSEN HAND SCREWS

Model	Jaw Length	Open Cap.	List	Sale	Box of 6
#5/0	4"	2"	11.59	7.25	39.15
#4/0	5"	2½"	12.45	8.10	43.75
#3/0	6"	3"	13.36	8.50	45.95
#2/0	7"	3½"	14.36	8.95	48.35
#0	8"	4½"	15.97	9.95	53.75
#1	10"	6"	18.25	11.35	61.25
#2	12"	8½"	20.94	13.60	72.95
#3	14"	10"	26.56	16.75	91.35
#4	16"	12"	34.55	23.75	128.25

JORGENSEN BAR CLAMPS STYLE 37 — 2½" Throat ¼" x ¾"

Model	Jaw Length	List	Sale	Lots of 6
3#3706	6"	7.88	5.50	29.70
#3712	12"	8.73	5.95	32.13
#3718	18"	9.64	6.95	37.53
#3724	24"	10.54	7.35	39.69
#3730	30"	11.76	8.25	44.55
#3736	36"	12.85	8.95	48.33

Who Has The Saws That Cut It Across The Board?

***BLACK & DECKER* of course!!!**

Model	WORM DRIVE SAWS	List	Sale
3050	6½" 12 amp - 4600 rpm	247	169
3051	7¼" 13 amp - 4300 rpm	232	149
3052	8¼" 13 amp - 4300 rpm	247	169
	SUPER SAWSCATS		
3047-09	7¼" w/brake - 12.5 amp	226	149
3048-09	8¼" w/brake - 13 amp	240	155
	BUILDERS SAW CAT		
3030	7¼" 13 amp - 5800 rpm	155	100
3035	8¼" 13 amp - 5800 rpm	175	125
3034	7¼" 13 amp - 5800 rpm	162	115
3033	6½" 13 amp - 5800 rpm	162	115
	JIG SAWS		
3157-10	var/sp orb action d/hdl	174	115
3153-10	var/speed 4.5A 0-3100	158	105
3159-10	2/sp orb action barrel grip	178	120
	CUT SAW KITS		
3103	2 sp 6 amp-2400 strokes	163	100
3105	v/sp 6 amp-2300 strokes	170	110
3107	v/sp orb 6A 0-2300 strokes	183	119
4300	Drill Bit Sharpener	289	205
1321	½" drill 450 rpm 6 amp	175	115
4010	Palm Sander	80	48
4015	½ Sheet Finish Sander	160	105
	DRYWALL GUNS		
2034	v.s.r. 0-4000 rpm	121	79
2037	v.s.r. 0-4000 rpm	139	89

"Door Openers" from MAKITA

9501B	4" Grinder Kit	119	55
2708	8¼" Table Saw	348	199
5007NB	7¼" Circ. Saw	158	94

MILWAUKEE BUY OF THE YEAR

Model 6365 — 7¼" Circular Saw

List $159.00 Sale $94.00

Lots of 3 — $279.00

***Brand New* • PORTER CABLE**

Model 7548 Top Hdle Jig Saw

LIST 199 — SALE 129.95

Model 7648 Barrel Jig Saw

LIST 199 — SALE 129.95

PORTER-CABLE

		List	Sale
9548	HD v/s bayonet saw w/case	255	169
9627	2 sp. tiger saw kit 8 amp	193	130
9629	V/sp. tiger saw kit 8 amp	204	135
505	H.D. ½ sheet finish/sander	175	100
330	spd bloc sander ¼ sheet sz	87	54
304	Professional 7" disc sander	169	120
305	Professional 7" polisher	169	120
7511	3/8" xtrahvy v/s drill 5.2 amp	164	115
7554	½" xtra hvy drill 8 amp	210	150
9652	Versa-Plane Kit	419	285
9118	Porta Plane Kit	289	190
	DRYWALL SHOOTERS		
7544	5.2 amp — 2500 rpm	158	105
7545	5.2 amp — 0-2500 rpm	158	105

AEG POWER TOOLS

Model		List	Sale
EZ 501	C/less Scrwdrvr **Brand New**	59	35
EZ 502	C/less Scrwdrvr-190 rpm	98	52
EZ 505	C/less Drill/Driver	139	79
EZ 506	C/less Electronic Dril/Drvr	159	94
EZ 581	C/less Caulk Gun var/sp	179	106
SCR1E	Drywall Screwgun 0-2000	125	74
SCR11E	Drywall Screwgun 0-4000	125	74
BE8RL	3/8" var/sp drill 3.8 amp rev	86	51
BE10RL	3/8" var/sp drill 5 amp rev	125	74
SBE401RL	3/8" Ham Drill v/sp h.d.	88	52
SE2E13RL	½" Ham Drill 2 sp h.d.	169	101
TC25E	Tech Driver v/sp 5 amp	150	89
PC70	7¼" Circular Saw 12 amp.	157	93
VS130	Orb Sndr 20,000 OPM ⅓ sh	75	48
VS260	Orb Sndr 25,000 OPM ½ sh	156	88
VSS260	Orb Sndr 25,000 OPM w/bag	189	118
Hbse75S	Belt Sander v/sp 3" x 21"	199	118
BSPE60	Jig Saw Orb v/sp 4.6A w/case	214	127
RSK600	Recip Orb Saw 10 amp	229	136

ROTARY HAMMERS

PHE 16RL	3.8 amp 5/8" capacity in concrete	269	175
PH 210	5.2 amp ¾" capacity in concrete	398	260
PHE 20	Same as above — except var/sp 0-750	418	270
PHD 26	6.3 amp 1" capacity in concrete	495	320
PH 38	7.5 amp 1½" capacity in concrete	549	355

All above complete with cases

SKIL TOOLS

		List	Sale
551	5½" Circ. saw 6.5A	99	73
77	7¼" Worm Saw	240	135
367	6½" Worm Saw	239	135
825	8¼" Worm Saw	270	165
807	7¼" Skllsaw 13A-Super	153	100
808	8¼" Skllsaw 13A-Super	172	110
2016-02	3/8" Cordless Drill complete W/Charger, Case & 2 batteries	199	95

Print this article

PONDEROSA PINE

the West's tall, lean, and rugged softwood

Exploring the headwaters of the Missouri River in 1804, the Lewis and Clark expedition sighted towering stands of trees more majestic than any they'd known before. Twenty years later, the English botanist David Douglas discovered these same trees growing along the Spokane River in what is now Washington state. Because of their ponderous dimensions and the comparative heaviness of their wood for pine, he named them "Ponderosa."

Ponderosa pine, Montana's state tree, is truly the wood of the West. Indians wove its long needles into baskets and jewelry. Ranchers felled it for barns and bunkhouses. On July 4, 1876, Arizona lumberjacks stripped branches from the tallest ponderosa they could find, and hoisted the American flag in celebration of the nation's centennial—that's how the town of Flagstaff got its name.

One of the most commercially important trees in the United States, ponderosa pine also has the distinction of being the subject of a Supreme Court ruling. A 1934 decision protects it from being sold under any name except ponderosa.

Ponderosa with heartwood | Ponderosa sapwood

Wood identification

Occasionally referred to as Western yellow pine and blackjack pine, ponderosa pine *(Pinus ponderosa)* is one of 35 pines native to North America. Mature trees have cinnamon to orange-brown, scaly bark on a trunk up to 8′ in diameter at chest height.

Needles up to 10″ long grow in threes along its branches, which also bear 6″-long, brown cones. "Young" ponderosa pines (under 100 years old) display dark brown to nearly black bark; hence the nickname blackjack pine.

In its native mountain slopes and well-drained uplands, the ponderosa can reach 200′ high. It is also a long-lived pine; specimens 500 years old are not uncommon.

Ponderosa pine stands tall in the saddle among softwoods. It is yellowish-white, hard, fine grained, and strong, yet light. Dry, it weighs about 25 pounds per cubic foot.

Working properties

As the finest of the pines available in volume today, this wood has all the excellent working qualities: You can cut and shape it by hand as well as with power tools; it glues extremely well; and it doesn't split readily. Because of ponderosa's texture, uniform cell structure, and comparative hardness for a softwood, it stains and finishes exceptionally well.

Uses in woodworking

The volume of ponderosa harvested makes it a mainstay of the construction industry. Knotty pine paneling and furniture for the popular country look come from this tree.

In the workshop, ponderosa pine easily fashions into furniture, wood novelties, toys, pastry boards, and cabinets. Carvers often choose it over other woods.

Cost and availability

Ponderosa pine is available in both "construction" dimension and hardwood dimension, such as 6/4. This makes for complex grading standards. Common grade lumber goes from no. 1 down to no. 5. Select grades, for furniture and cabinets, consist of B and Better (the highest), C-Select, D-Select, and Factory Select. The lowest grades are no. 1, no. 2, and no. 3 Shop.

Cost, of course, varies with the grade, but even top grades carry more moderate prices than some cabinet-class hardwoods.

Sources of supply

Growing in 11 western states, as well as in the Black Hills of South Dakota, ponderosa pine has the greatest range of any commercial tree in America—approximately one third of the U.S.

Photographs: Hopkins Associates
Illustration: Steve Schindler

MANY HAPPY

Print this article

Whoosh, whoosh, whoosh. Spinning at 10 revolutions per second, the boomerang approaches a speed of 55 mph along its circular path.

Chet Snouffer, 29, makes and sells boomerangs. He also throws them—well enough to win the 1985 world championships held in Paris. In the U.S. Boomerang Association, Chet has been U.S. national champion and lead American scorer in international competition.

His presence on the throwing field draws respect from competitors, as do the bagful of boomerangs he brings with him (many are shown above). Chet's infamous "Black Rose," for instance, visible at far left against the bag, returns so precisely and consistently that it seems to have eyes. Chet engineered it that way, just as he builds each of his competitive models for a specific throwing event.

Where did it all begin? Inspired by an encyclopedia article he read on the subject when he was 10, Chet made his first boomerang of ¼" wall paneling. He continued making boomerangs through high school and in college—selling them to earn some spending money.

While Chet's life appears to revolve around boomerangs, his greatest pride comes from the success of the gymnastics teams he coaches in junior high school and in city recreation programs. He and his wife, Carmen, make their home in Delaware, Ohio.

RETURNS!

Boomerangs By World Champion Chet Snouffer

A bright windsock festooned with streamers hangs motionless on its pole, then jumps suddenly in response to a sprightly gust. Forty yards away in the open field, a young man stops his motion, hesitating only momentarily to read the wind. He turns, cocks his arm and steps quickly forward. Like an arrow released, his arm shoots out, freeing the object in his hand. A rotating blur, the boomerang tracks its sweeping arc toward the windsock, whispering as it travels.

"Boom, baby. Come on back," says Chet Snouffer, as his boomerang reaches the apex of its path, banks steeply, and flashes in the sun, then begins its return trip. Seconds later, he leaps, claps his hands together in a catch, and alights with the boomerang.

Partly from years of throwing, partly because of his physical education training, and partly through natural ability, Chet can repeat the sequence 150 times without a drop. He can catch with both hands, either hand, between his legs, behind his back, or on his back. And he can do all that almost as well while throwing two!

But Chet does more than throw boomerangs—he makes the ones he throws. That's why he "talks" to them in flight, and one of the reasons he's a world champion.

BOOMERANGS DIDN'T ALWAYS COME BACK

According to Chet, a boomerang isn't a boomerang until it comes back, because that's its job. Talking to it doesn't help much, either, but "it's part of the experience."

"That sounds funny," he explains, "but you develop a personal relationship with each one. That's because you make a boomerang to do a special thing, and customize it to perform in a certain way."

Oddly enough, the first boomerang in history to find its way back may simply have been a disappointing accident.

It appears that Australia's aborigines, as well as Indians of the American Southwest, used slightly curved, wide-angled throwing sticks for hunting game. Contrary to popular belief, however, these sticks weren't designed to return. They flew a low, flat, and straight trajectory that would deliver a knockout punch to fleet-footed animals or flying fowl. Throwing sticks didn't have to return—they were fetched with the prey.

While no one really knows exactly how the boomerang originated, speculation has it that an aborigine hunter unsuspectingly cut a throwing stick with too narrow an angle (most returning boomerangs have 90–120° angles between their arms). Then, again unknowingly, he may have shaved it with his primitive knife just enough to give it lift. Can you imagine his amazement when he first threw the newly fashioned weapon and it unexpectedly returned to him?

Since then, boomerangs developed first into a novelty plaything, then into the sophisticated sporting equipment of today's regional, national, and international competitions. In fact, Chet believes that the boomerang has the potential to become the Frisbee of the Eighties.

You can toss a boomerang just for the fun of it, as Chet first did, and, as skill develops, enter friendly local contests. That's how he began competing, advancing eventually to the annual Smithsonian boomerang throw in Washington, D.C. From there he teamed up with other top boomerangers to travel once a year to international events.

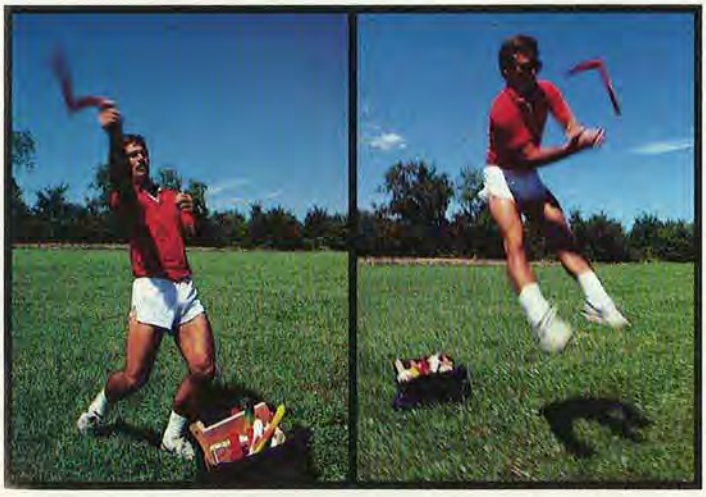
HOW A BOOMERANG FLIES

Boomerangs can be made from any lightweight wood, plastic, or even metal. Chet suggests, however, that the best are made of laminated wood, such as many-plied aircraft plywood. Strong, yet light, aircraft plywood resists warp. Chet uses ¼", 7-ply material, and turns out a boomerang in five minutes. (See how you can make one of Chet's boomerangs on the next page.)

No matter what boomerangs are made of, they all fly practically the same once in the air. First, though, you have to get them there.

Chet readies for a throw by checking wind direction. No wind is ideal, but should there be a breeze, he faces it at about a 45° angle. Grasping the leading arm of the V-shaped boomerang and pinching it between the thumb and index finger of his right hand, the flat underside away from his body, he points the "V" outward in the direction of throw. Then, in a quick, whip-like motion, he brings his arm forward for the release.

Continued



Far left: **In a throw likened to an overhead tennis smash, Chet Snouffer launches his boomerang for its 18-second flight.**

Left: **Jumping, acrobatic catches become part of the show in a throwing competition. Here, Chet's about to make a risky, one-handed grab.**

BUILD YOUR OWN BOOMERANG

The Seabreeze II Boomerang, a championship model designed by Chet Snouffer, guarantees you hours of fun for a minimal investment of time and material. Make several!

Traveling at about 50 mph and revolving 10 times a second, the boomerang starts in a nearly vertical stance, like a speeding car tire. As it rotates, the lifting arm cuts through the air first and the trailing arm follows in the turbulence, with the result that each arm of the boomerang looses lift and airspeed. This phenomenon helps the boomerang keep its balance.

In the air, the boomerang exhibits fascinating behavior. At first vertical, it carves an arc through the sky to the thrower's left (or right, if thrown left-handed). Reaching the completed circumference of its path, the boomerang begins to lay down in a speeding horizontal position. Its circular journey completed, the boomerang hovers like a helicopter, ready to be caught.

THE BEAUTY OF BOOMERANGS

On those summer afternoons when the sun starts its sultry decline, Chet's neighbors haul their lawn mowers out for a cool clip. But Chet hauls out his boomerangs and heads for the open fields.

"Once, my only concern was how little time the boomerang spent dilly-dallying along its path," notes Chet. "The less it hovered around, the faster it returned and the better it was for me in competition. What fascinates me now is the dipping, soaring, and hovering."

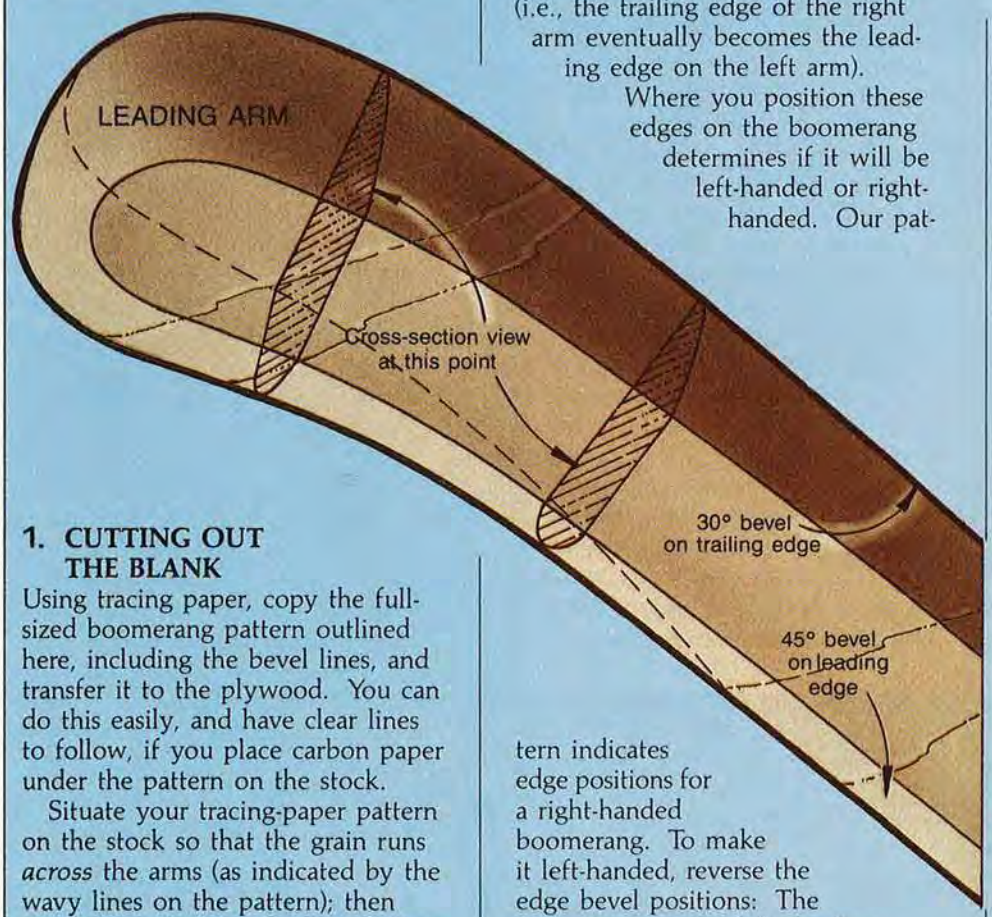
Whenever weather permits, Chet fits his boomeranging into the day. Competition still happens to be exciting to him, but other things count even more—such as a boomerang brightened by the sun.

"A boomerang doesn't look like much sitting still, but when it's rotating, the thing has a unique beauty," Chet remarks, spinning his hand in the air. "Then, that piece of wood becomes a boomerang."

Interested in boomerangs? Write: *U.S. Boomerang Association, P.O. Box 2146, Lower Burrell, PA 15068; Free Throwers Boomerang Society, 51 Troy Rd., Delaware, OH 43015.*

Produced by Peter J. Stephano
Photographs: Jim Elder

Note: You'll need a 9 × 13 × ¼" (6 mm) piece of five- or seven-ply Baltic birch aircraft plywood (or good marine-grade plywood) to make your boomerang. Check the Buying Guide at the end of this article for sources.



1. CUTTING OUT THE BLANK

Using tracing paper, copy the full-sized boomerang pattern outlined here, including the bevel lines, and transfer it to the plywood. You can do this easily, and have clear lines to follow, if you place carbon paper under the pattern on the stock.

Situate your tracing-paper pattern on the stock so that the grain runs *across* the arms (as indicated by the wavy lines on the pattern); then trace the outline on the wood. Your wood will still work even if it has a warp to it, but you must trace the pattern and form the edges of the boomerang on the side of the stock that dishes upward.

Use a band saw, jigsaw, or scroll saw to cut out the boomerang blank from the plywood.

2. MARKING THE BEVELS

The top of the boomerang has two tapered edges, called *airfoils.* The leading edge has a 45° bevel, and the *trailing* edge has a 30° bevel (see pattern). Note that these edges blend into each other and gradually switch positions on the boomerang (i.e., the trailing edge of the right arm eventually becomes the leading edge on the left arm).

Where you position these edges on the boomerang determines if it will be left-handed or right-handed. Our pattern indicates edge positions for a right-handed boomerang. To make it left-handed, reverse the edge bevel positions: The trailing arm becomes the leading arm and its leading edge and trailing edge trade locations.

This isn't as confusing as it first may seem, if you remember that a *leading edge* must cut the air first when you throw the boomerang. That's important, because otherwise it won't fly!

3. SHAPING THE BOOMERANG

With a drum sander in a drill press, a disk sander in a portable drill, or by hand with a rasp, put a 45° bevel completely around the top side of the blank. Exactness isn't critical, so you can simply eyeball the bevel.

Next, sand back the bevel on the trailing edges as marked on the pattern until you have a 30° taper. Be sure to gradually blend trailing edges into leading edges. Refer to the boomerang-arm cross sections for the proper edge taper at both ends and in the center of the boomerang.

Finish sanding the edge contours by rounding off the 45° bevel of the leading edges to a bullnose. Now, turn the boomerang over and sand a slight tapering bevel along the leading edges for about 2½" from the tip of each arm, as indicated by the dashed line on the pattern. This bevel tends to add an even lift. Note the shape of the arm tips as indicated in the cross section views.

4. SANDING AND FINISHING

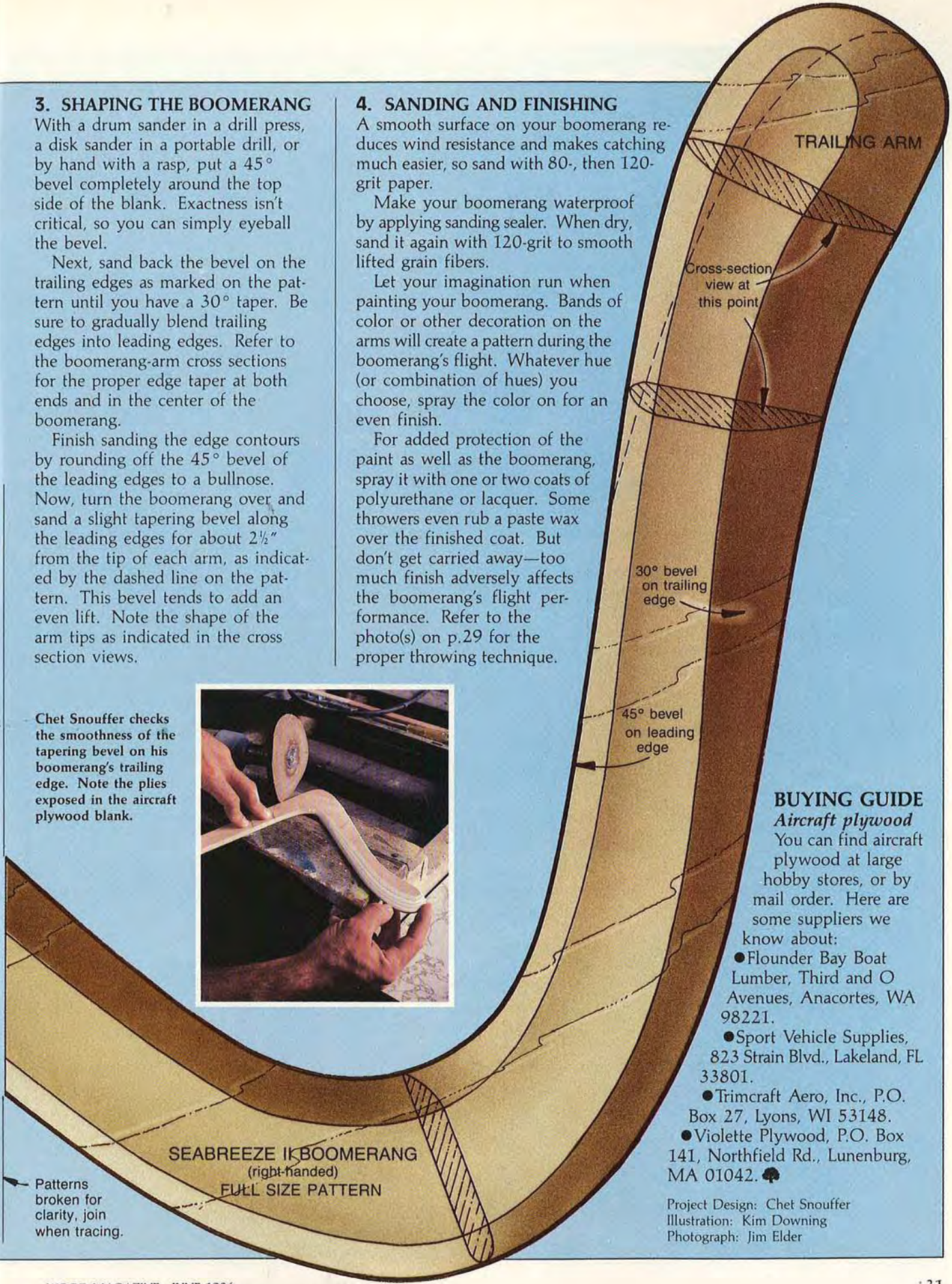
A smooth surface on your boomerang reduces wind resistance and makes catching much easier, so sand with 80-, then 120-grit paper.

Make your boomerang waterproof by applying sanding sealer. When dry, sand it again with 120-grit to smooth lifted grain fibers.

Let your imagination run when painting your boomerang. Bands of color or other decoration on the arms will create a pattern during the boomerang's flight. Whatever hue (or combination of hues) you choose, spray the color on for an even finish.

For added protection of the paint as well as the boomerang, spray it with one or two coats of polyurethane or lacquer. Some throwers even rub a paste wax over the finished coat. But don't get carried away—too much finish adversely affects the boomerang's flight performance. Refer to the photo(s) on p.29 for the proper throwing technique.

Chet Snouffer checks the smoothness of the tapering bevel on his boomerang's trailing edge. Note the plies exposed in the aircraft plywood blank.



BUYING GUIDE

Aircraft plywood

You can find aircraft plywood at large hobby stores, or by mail order. Here are some suppliers we know about:

- Flounder Bay Boat Lumber, Third and O Avenues, Anacortes, WA 98221.
- Sport Vehicle Supplies, 823 Strain Blvd., Lakeland, FL 33801.
- Trimcraft Aero, Inc., P.O. Box 27, Lyons, WI 53148.
- Violette Plywood, P.O. Box 141, Northfield Rd., Lunenburg, MA 01042.

Project Design: Chet Snouffer
Illustration: Kim Downing
Photograph: Jim Elder

Come 'n' get it! Print this article

Portable Patio Party Wagon

This versatile serving cart makes the perfect companion to the stylish chairs and chaise lounge we featured on p. 58 of the June, 1985 issue of *WOOD*. Constructed of weather-resistant redwood, the cart features a sliding top that hides a storage bin below—the ideal spot for stashing all those barbecue accessories and for serving food and drinks.

START WITH THE FRAMEWORK

1 Rip ¼" from each edge of all 2×4 stock for 3" finished width. (This removes the factory-rounded edges and lets you make tighter-fitting, better-looking joints.) Crosscut the legs (A, B) and rails (C, D) to length.

2 Mark a 1½" radius on the bottom end of each A leg and the handle end of each C rail. With a band saw or jigsaw, cut just outside the marked line; then, sand to the finished contour.

3 Using the radius centerpoint on each top rail C as a guide, bore a 1" hole through both for the handle. Be sure to back the rails with scrap as you bore the holes to prevent tearout on the backside.

4 Measure and mark the half-lap joints on the legs and rails where shown in the Top-View and Side-Section Drawings. Using a dado blade, test-cut half-lap joints on the ends of two scraps of the redwood stock. Check the fit of the two pieces and adjust the depth of cut if necessary. Cut a 3"-wide half-lap in the top end of each A, both ends of B and D, and the non-radiused end of each C. Cut a 3"-wide dado where dimensioned on A and C.

5 Cover the exposed end grain at the half-lap joints with masking tape. (This protects the wood from epoxy squeeze-out, which can cause unsightly stains after finishing.) Epoxy and clamp the two cart sides (A, B, C, D) together, checking for square. (We chose epoxy as the adhesive for its strength and moisture resistance.) Let the epoxy set thoroughly overnight before any further machining.

6 Remove the masking tape and sand the joints flush. Cut the 1" radius on the front edges of each of the side assemblies at both the top and bottom (see the Exploded View for particulars). Sand the edges and rounded corners smooth. With a router and a ¼" round-over bit, rout all edges (except where E joins later) on both sides of each assembly.

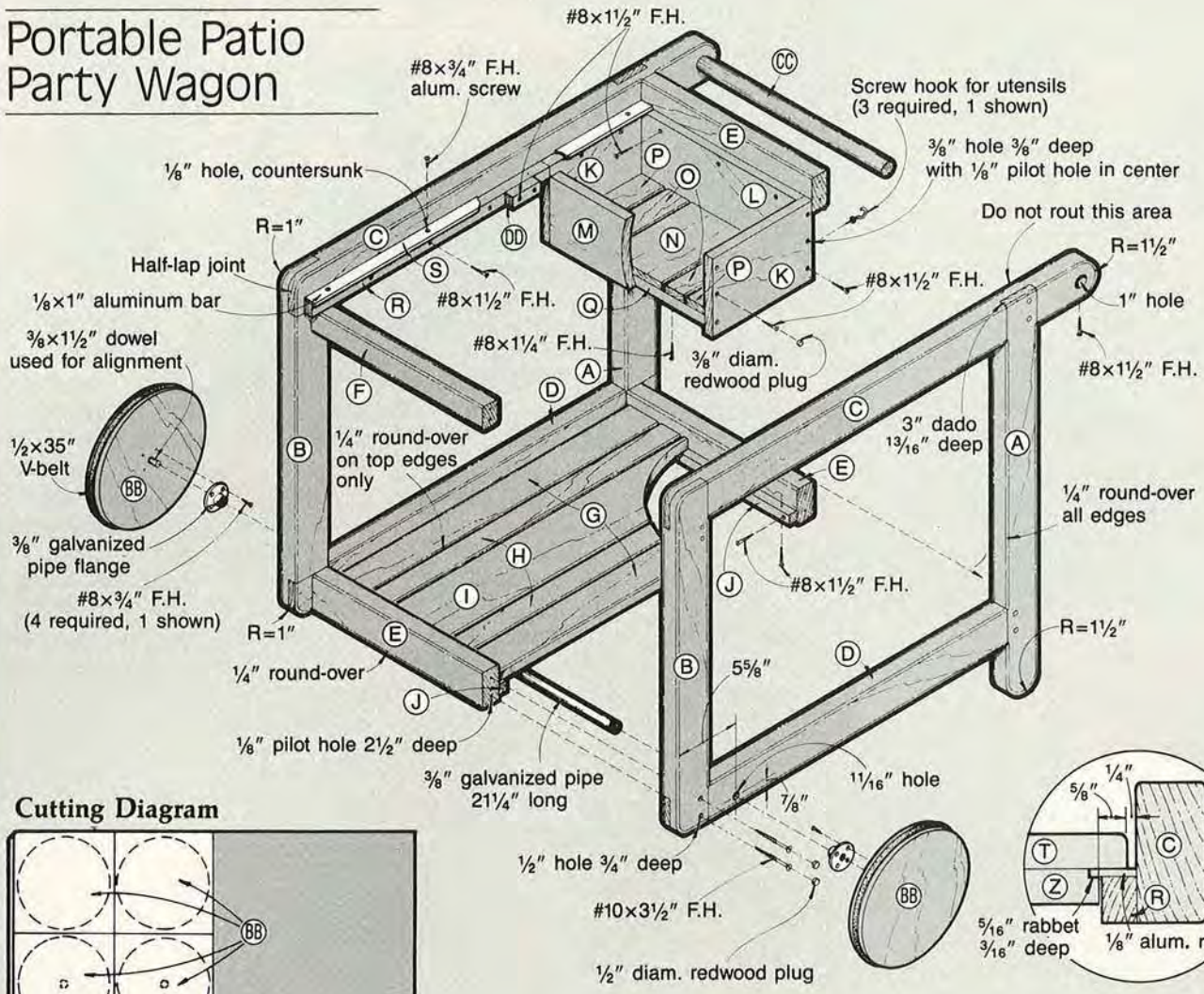
7 Cut the stretchers (E, F) to size as listed in the Bill of Materials, and rout the lengthwise edges with a ¼" round-over bit. With a helper, position and dry-clamp the stretchers between the two side assemblies where shown in the Side-Section and Top-View Drawings. Using a ½" bit, bore holes ¾" deep on the outside of the side assemblies (to accept wooden plugs) where the stretchers meet (see the Exploded-View Drawing). Switch to a ⅛" bit, and drill pilot holes through the sides and into the ends of the redwood stretchers.

8 Remove the clamps, and apply epoxy to the ends of the stretchers and to the mating surfaces on the side assemblies. Then reassemble and clamp the cart frame together. Apply epoxy to the threads of #10×3½" screws, and drive the screws into the ⅛" pilot holes.

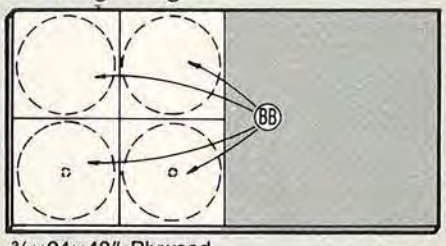
Using a sharp plug cutter, cut ½"-redwood plugs, and epoxy them in place to conceal the heads of the #10 screws. After the epoxy sets, sand the plugs flush, and finish-sand the entire frame.

Continued

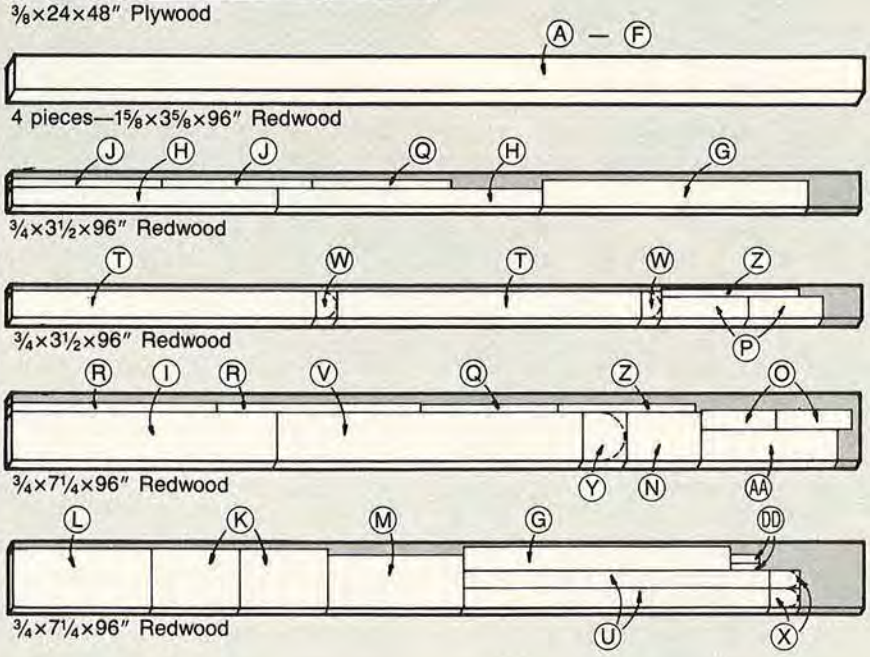
Portable Patio Party Wagon

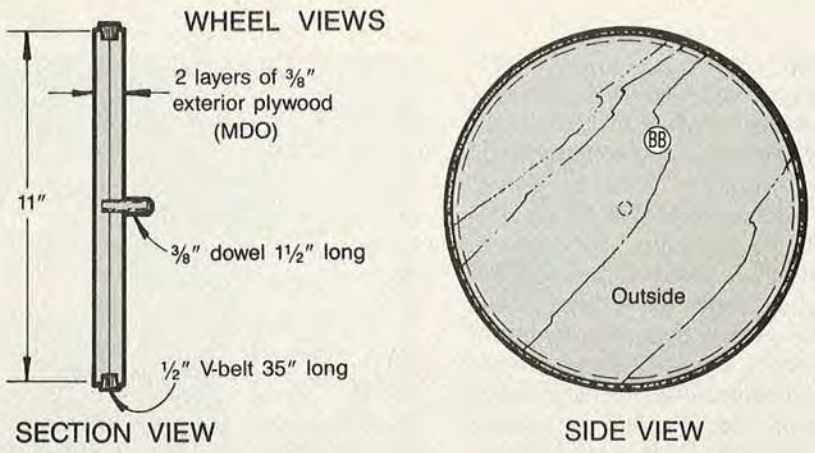


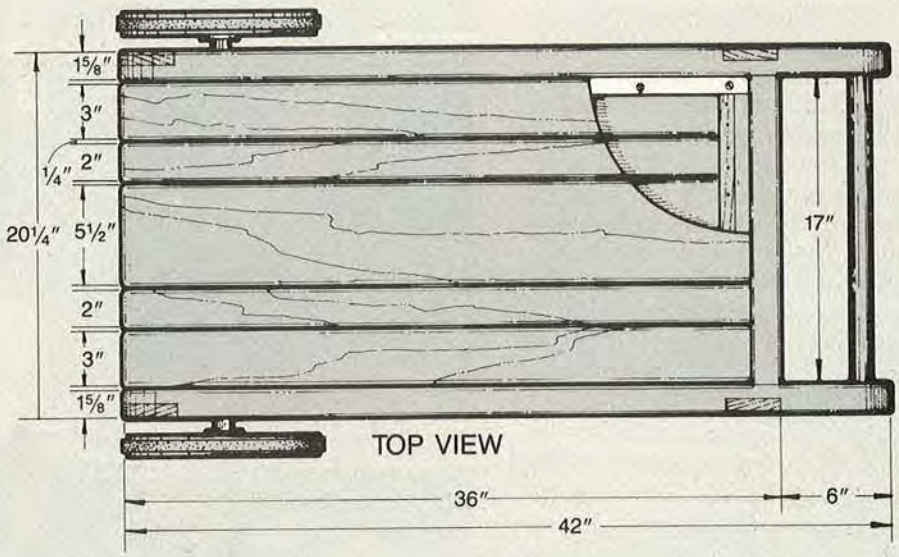
Cutting Diagram

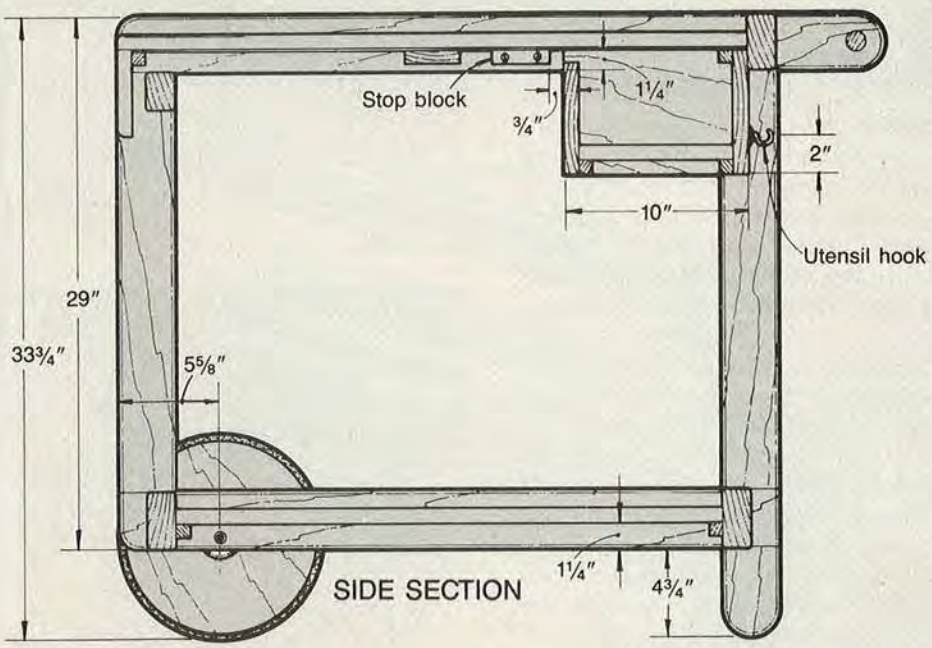


⅜×24×48" Plywood


A — F
4 pieces—1⅝×3⅝×96" Redwood
J H J Q H G
¾×3½×96" Redwood
T W T W Z P
¾×3½×96" Redwood
R I R V Q Z O Y N AA
¾×7¼×96" Redwood
L K M G DD U X
¾×7¼×96" Redwood







Bill of Materials

Part	Finished Size*			Material	Qty.
	T	W	L		
A	1 5/8"	3"	33 3/4"	redwood	2
B	1 5/8"	3"	29"	redwood	2
C	1 5/8"	3"	42"	redwood	2
D	1 5/8"	3"	36"	redwood	2
E	1 5/8"	3"	17"	redwood	3
F	1 5/8"	2"	17"	redwood	1
G	3/4"	3"	30"	redwood	2
H	3/4"	2"	30"	redwood	2
I	3/4"	5 1/2"	30"	redwood	1
J	3/4"	3/4"	17"	redwood	2
K	3/4"	6 3/4"	10"	redwood	2
L	3/4"	6 3/4"	15 1/2"	redwood	1
M	3/4"	6"	15 1/2"	redwood	1
N	3/4"	5 1/2"	8 7/16"	redwood	1
O	3/4"	2"	8 7/16"	redwood	2
P	3/4"	2 1/2"	8 7/16"	redwood	2
Q	3/4"	3/4"	15 1/2"	redwood	2
R	3/4"	1"	23 3/4"	redwood	2
S	1/8"	1"	33 1/2"	aluminum	2
T*	3/4"	3"	34 1/2"	redwood	2
U*	3/4"	2"	34 1/2"	redwood	2
V*	3/4"	5 1/2"	34 1/2"	redwood	1
W*	3/4"	3"	2 1/4"	redwood	2
X*	3/4"	2"	3 1/2"	redwood	2
Y*	3/4"	5 1/2"	4 3/4"	redwood	1
Z	3/4"	3/4"	15 1/4"	redwood	2
AA	3/4"	3"	15 1/4"	redwood	1
BB*	3/8"	11" diam.		ext. plywood	4
CC	1" diam.		20 1/4"	dowel	1
DD	3/4"	3/4"	4"	redwood	2

*Some parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: #8×3/4" flathead aluminum screws, #8×1 1/4" flathead wood screws, #8×1 1/2" flathead wood screws, #8×3/4" flathead wood screws, #10×3 1/2" flathead wood screws, 1/2"-diameter redwood plugs, 3/8"-diameter redwood plugs, 3/8×21 1/4" (11/16" O.D.) galvanized pipe threaded on both ends, 2—3/8" galv. pipe flanges, 2—1/2×35" V-belt, 3/8" hardwood dowel, 3—screw hooks, redwood stain, exterior polyurethane, oil-base primer, exterior white paint, epoxy, masking tape, double-faced tape

Continued

Portable Patio Party Wagon

NEXT, BUILD THE LOWER SHELF

1 Cut the lower-shelf slats (G, H, I), and shelf cleats (J) to size as listed in the Bill of Materials. Using a ¼" round-over bit, rout the top edges of each slat. Finish-sand the pieces and arrange them top side down on a flat surface.

2 Cut eight ¼×¾×4" scrapwood spacers, and insert them between G, H, and I. Dry-clamp the spacers and shelf slats together, making sure that all the ends of the slats align. Epoxy and screw the cleats to both ends of the shelf slats.

NOW, ON TO THE STORAGE BIN

1 Cut the bin ends (K) and sides (L, M) to size. Drill holes in K as directed in the Exploded-View Drawing. Then epoxy and screw the ends and sides together, making sure that the bottom edges of the four pieces are flush with each other. Remember, too, to check for square. Cut ⅜" redwood plugs and epoxy them in place. Finish-sand the redwood bin.

2 Cut the bin slats (N, O, P) and the bin cleats (Q) to size. Using a ¼" round-over bit, rout the top-side edges of all the slats, except for the outside edge of each P. Finish-sand the slats and arrange them top side down on a flat surface.

3 Place the same ¼" spacers used in the lower shelf construction between the slats and clamp the slats, and spacers together. Epoxy and screw the cleats flush with the ends of the slats.

THE TOP SHELF COMES NEXT

1 Cut the slide rail supports (R) to size, and clamp them in place on the frame. Drill and countersink ⅛" pilot holes in the rails; then, epoxy and screw the rail to the frame.

2 Cut the ⅛×1" aluminum slide rails (S) to length, and clamp them in place on top of the slide rail support (R). Drill and countersink ⅛" holes in the slide rails where shown in the Exploded-View Drawing, and drive #8×¾" aluminum flathead screws in place.

3 Rip the top-shelf slats (T, U, V) to width, then crosscut to length *plus* 8" (the excess will be used to make the draped slat ends), shown in the Top-Shelf Drawing. Crosscut W, X, and Y from the long pieces. Using the Front-View Drawing as reference, mark the radii on pieces W, X, and Y. Cut the pieces to shape; then sand them smooth.

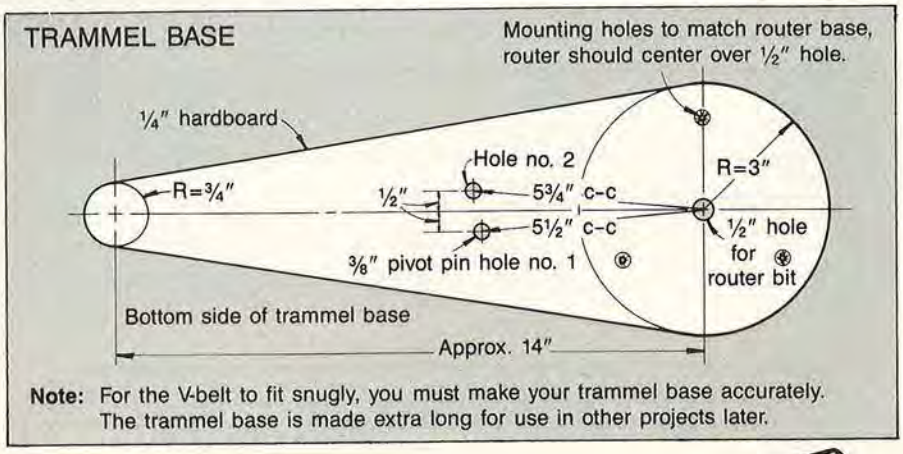
4 Epoxy and clamp pieces W, X, and Y to pieces T, U, and V, again taping the exposed end grain. When the epoxy has set, use a ¼" round-over bit to rout all the outside edges of the slats. Finish-sand the slats, and arrange them top side down on a flat surface. Insert the same ¼" spacers used earlier, and clamp the spacers and slats together.

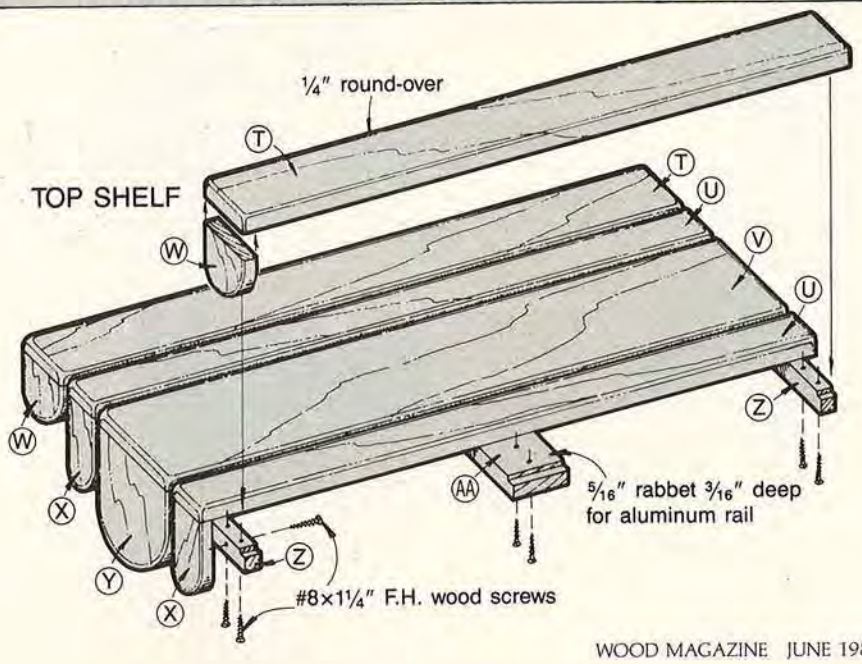
5 Cut the top-shelf cleats (Z, AA) to size. Cut a 5/16" rabbet 3/16" deep in each end of the cleats. Epoxy and screw the cleats to the slat assembly (see the Top-Shelf Drawing for positioning particulars).

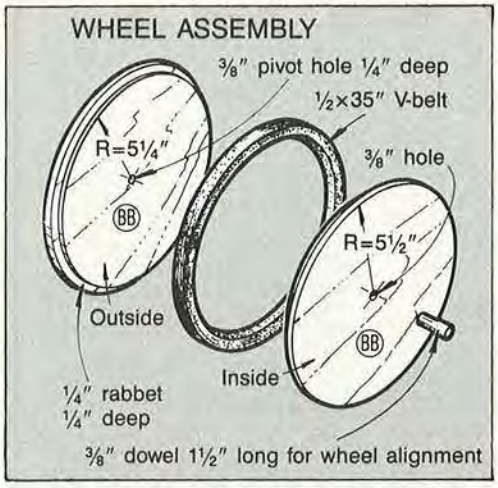
HERE'S HOW TO FASHION THE WHEELS

Note: *To make the wheels, you need a trammel base for your router. (See the Trammel-Base Drawing,* below, *for construction how-to.)*

1 From ⅜" exterior plywood, cut four wheel blanks (BB) to 12×12". (We suggest you also cut a couple of test blanks from scrap to get the feel of using the trammel base and to check the fit of the V-belt.) Draw diagonal lines to locate the center of each blank and mark two of the


TRAMMEL BASE
Mounting holes to match router base, router should center over ½" hole.
¼" hardboard
R=¾"
½"
Hole no. 2
5¾" c-c
5½" c-c
⅜" pivot pin hole no. 1
R=3"
½" hole for router bit
Bottom side of trammel base
Approx. 14"
Note: For the V-belt to fit snugly, you must make your trammel base accurately. The trammel base is made extra long for use in other projects later.





blanks "inside" and two of them "outside." Drill a 3/8" hole on center completely through the "inside" blanks and only 1/4" deep in the "outside" blanks.

2 From 3/8" dowel stock, cut two pieces to 1 1/2" in length.

3 Tack the blanks one at a time onto a scrap piece of plywood. Fasten the trammel base on your router and set it on the blank, using one of the 3/8" dowels as a pivot pin in hole no. 1 (again, refer to the Trammel-Base Drawing). Using a 1/2" straight bit, rout a 1/2" rabbet 1/4" deep in each blank, pivoting the router around the center point as shown in photo A.

4 Switch the pivot pin to hole no. 2 and repeat the cut, widening the rabbet as shown in photo B.

5 Lower the router bit to cut completely through the blank and make a third pass on each blank, again with the pivot pin in hole no. 2 as shown in photo C.

6 Test-fit the inside and outside wheel halves, the alignment dowels cut earlier, and V-belt as shown in the Wheel-Assembly and Wheel-Views Drawings. Epoxy the wheel halves, dowel, and V-belt together for each wheel.

FASTEN THE WHEELS TO THE CART

1 Using an 11/16" bit, bore the axle holes through the lower rails (D) where indicated in the Exploded-View Drawing. Apply some epoxy to the threading, and thread a 3/8"-galvanized pipe flange onto one end of a 3/8×21 1/4" piece of galvanized pipe, threaded at both ends. (Your local hardware store or a plumbing-supply house will thread pipe for a small charge.)

Insert the wheel-alignment dowel into the end of the pipe, centering the wheel; then screw the flange to the wheel.

2 Insert the pipe through the axle holes on the frame so that the wheel flange is butted against the frame. Thread a second flange onto the opposite end of the pipe until it fits snugly against the redwood frame. (Initially, the wheels will turn stiffly, but the flanges will wear a smooth groove into the frame, allowing the wheels to turn smoothly without excess side-to-side motion.) Unscrew the flange, then remove the axle from the cart and the wheel from the flange.

3 Cut the handle (CC) to size.

FINISHING AND FINAL ASSEMBLY

1 Finish-sand, then stain the framework, bin case, and cleats. Later, apply several coats of exterior polyurethane.

2 Prime and paint all the slats, bin shelves, and handle. Mask the exposed top edges of the belts on the wheels. Prime and paint the wheels.

3 Drill pilot holes through both J cleats and screw the bottom shelf on the frame. Drill pilot holes through both Q cleats and screw the bin shelf in the bin assembly. Drill pilot holes through both K's and L, and fasten the completed bin to the frame.

4 Reattach the wheel to the flange, and reinsert the pipe through the frame. Screw the other wheel to the second flange, spread epoxy on the threading, and thread the flange tight onto the pipe.

5 Cut the stop blocks (DD) to size. Position the top shelf so the storage bin is fully exposed, then screw the stop blocks to the slide rail (R).

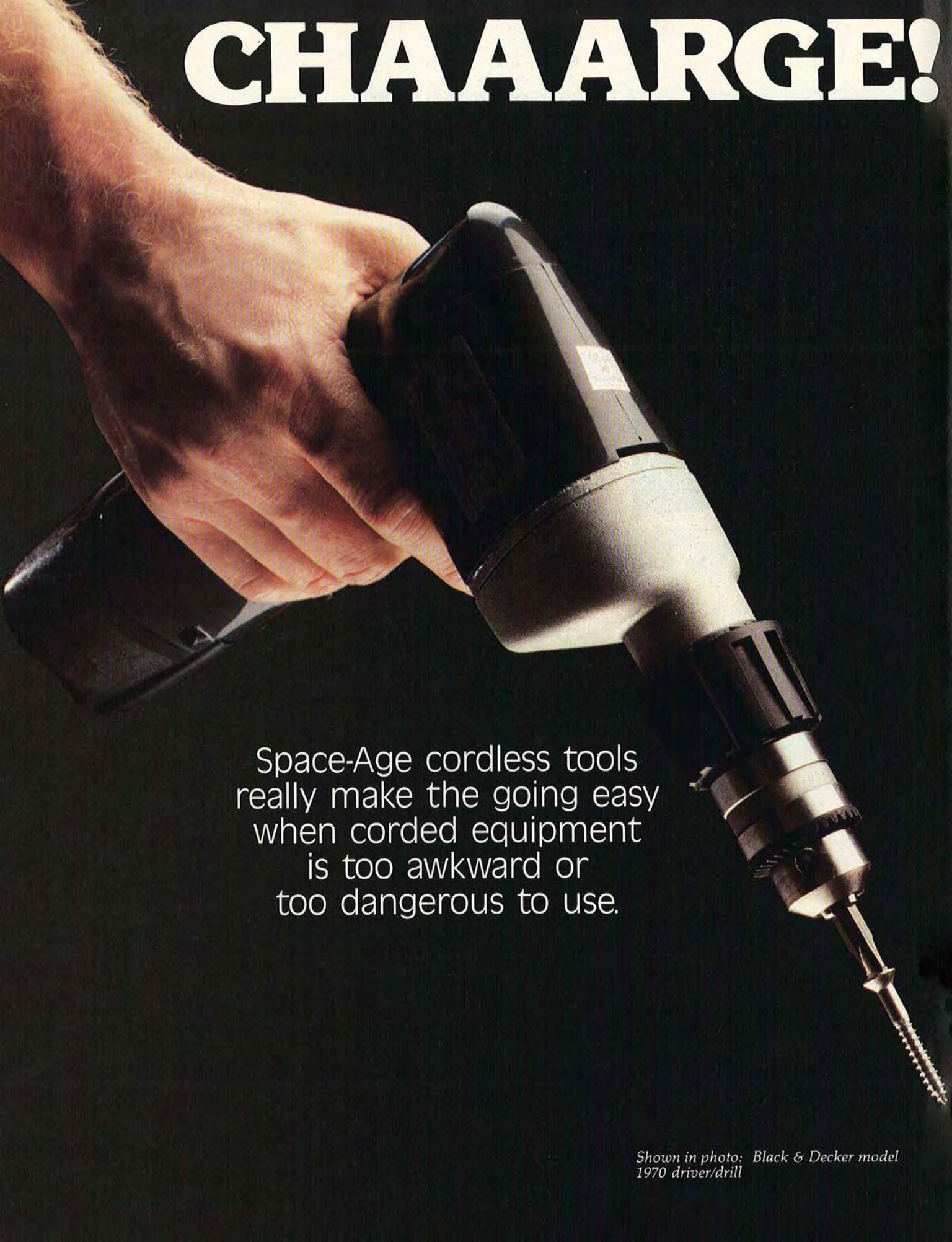
6 Install the handle in the frame, and drill 1/8" pilot holes in the underside of the frame. Drive screws in place, locking the handle in place. Attach the utensil screw hooks and you're ready to put your patio cart to work.

BUYING GUIDE

● ***Aluminum stock.*** 1/8×1×96" rectangular stock. Macklanburg-Duncan stock no. 0741-3123. $7.98 ea. You can purchase M-D products through Ace and True Value Hardware Stores, Payless Cashways Home Centers, and other hardware dealers.

Produced by Marlen Kemmet
Project Design: James R. Downing
Photographs: Perry Struse; Hopkins Associates
Illustrations: Randall Foshee; Bill Zaun

CHAAARGE!



Space-Age cordless tools
really make the going easy
when corded equipment
is too awkward or
too dangerous to use.

Shown in photo: Black & Decker model 1970 driver/drill

Drivers and drills you can use just about anywhere

Battery-operated drills and screwdrivers have come a long way since NASA first ordered them for use by astronauts in space two decades ago. (One AEG model that slipped from an astronaut's grasp last year still is orbiting out there among the heavens somewhere.)

Back here on earth, manufacturers of cordless tools, which were developed originally for commercial use, have overcome the drawbacks that plagued early models. These irritations included bulky battery packs, long charge times, and short-lived power. The new breed of commercial cordless tools charges in just one hour, compared to the 11–24 hours it took to recharge early models.

Don't overlook the consumer class of cordless tools, either. As with so many other advances in tool technology, consumer tools are beginning to reflect the improvements made earlier in commercial models. Several consumer drills and screwdrivers feature storage stand/chargers that keep the tools at peak charge constantly for the occasional user. However, keep in mind that such consumer tools are designed primarily for light use; it takes 3 to 21 hours to recharge them if they become fully depleted.

Should you have a cordless tool on your workbench? If convenience is worth paying perhaps double the price of a comparable corded tool, the answer is yes. But remember that cordless models cannot perform all the tasks of a conventional corded tool: You can't drill a 1" or 2" hole with the 100-watt motor of a cordless tool.

Let's take a closer look at each of the three categories these tools fall into: driver/drills, screwdrivers, and drills.

Driver/drills: The do-it-all tools

Unfortunately for the pocketbook of the typical home woodworker, all true driver/drills (i.e., those with adjustable clutches) are commercial models that retail for $150–$200. However, the price tag may not be out of reach if you take the driver/drills' versatility into account. And, remember, companies across the country are discounting power tools like mad these days.

Driver/drills usually feature two speeds—one for drilling and another less than half that fast for driving screws. We think that a clutch is the feature that "makes" a driver/drill. Budget permitting, we recommend this type.

The clutch allows the chuck to slip at a given torque, which means that you can stop the movement without having to hope you can sense when the screw is about to break through your workpiece. It also permits you to set various types of screws into materials of varying densities.

Clutchless driver/drills, on the other hand, operate at a slow speed. At, say, 150 rpm, the added torque and reaction time let you use a clutchless tool to drive screws. You won't get the consistent results of a clutch, but the trade-off is money in the pocket.

Most two-speed tools, even the clutchless ones, have mechanical

Continued

AEG EZ 505

HITACHI DRC-10

B&D 1970

RYOBI BD-1020R

- **A** 1-hr. quick charger
- **B** Speed changer
- **C** Bit storage
- **D** Chuck-key storage
- **E** Clutch adjustment
- **F** Battery pack in handle

CORDLESS DRILLS & SCREWDRIVERS

Driver/drills *continued*

gear-reduction systems that allow you to change speeds by turning a dial or sliding a lever. This physically changes gear ratios to alter speed. AEG, B&D Consumer, Milwaukee, and Skil take another approach—actually controlling current to the motor, either with a rheostat or electronically.

Faced with this choice, we prefer electronic control over the rheostat for two reasons: (1) constant r p m as load increases until motor and power capacity are reached; and (2) less stress on the battery. The microprocessor built into electronically controlled drills automatically monitors the r p m of the tool and increases power to the motor to keep rpm constant. This also increases torque as required. The low-end gear range of 0–250 rpm operates slowly enough that you can get by with using it as a driver/drill with less chance of damaging the work or the tool.

We do have some reservations about choosing the electronic approach to speed control over mechanical means. When you decrease speed with gearing, you increase torque delivered at the business end. But when a tool slows via electronics, torque delivered does not increase—you're just adding stress to the motor.

Screwdrivers: A good "second" cordless choice

In most instances, the driver/drill makes the best first cordless buy, but a screwdriver surely is the next cordless tool you should have in your hand. It's specialized to the point of only doing screwing and nut-driving, but it still has advantages over driver/drills or drills.

Size is the big plus. Both commercial and consumer models measure shorter from front to back or slimmer than any drill (except for the right-angle Makita). This compactness allows you to maneuver them in spots you can't reach with cordless driver/drills, which are larger than cordless drill-only tools. That's because of speed-control and clutch components.

The five commercial screwdrivers on the market range in price from $98 to $200. Two years ago, Skil introduced the first consumer screwdriver (the 2305) for under $40; last fall, Skil brought out the TWIST® for under $20, breaking the price barrier for the home craftsman.

AEG EZ 502 with bendable handle.

The EZ 502 is great in a tight spot.

Skil TWIST® in wall-mounted trickle-charge stand.

Commercial or consumer: Which tool for you?

Choosing the *right* tool for the job presents one of the oldest dilemmas for the home woodworker. In the case of power tools and cordless tools, you can make a convincing case for both consumer and commercial machines. In most instances, we recommend commercial tools for quality. But if a tool won't be used extensively or precision isn't critical, a consumer model may make the most sense when you compare prices.

Consumer tools can cost less than half as much as their commercial counterparts, but their limitations can make them frustrating to use. Consumer screwdrivers, for example, may lack the power, precision, and removable battery and clutch featured in the quality commercial models such as AEG and Makita.

In the case of cordless drills and driver/drills, the less-expensive tools may not cause as much aggravation for the home woodworker as they would in precision cutting tools such as routers. Yet, you have to consider the risk of running completely out of juice and having to wait from 3 to 21 hours to use your tool again.

Changeable batteries featured in commercial tools let you keep one charging while you use the other. B&D uses only one type of battery in all but one of their tools; the others use two sizes in their lines. By only using one or two sizes, you can purchase tools from the same manufacturer in the same voltage category and use the same charger and batteries.

Consumer tools have built-in power packs. Because the replacement cost isn't much less than the cost of the tool, you can consider consumer tools disposable in this respect. In some instances, it may be wise to buy two or three consumer tools for the price of one commercial unit. The consumer tools won't work as well or last as long, but you can have the convenience of always leaving one charging.

The shaft lock on the new B&D 9021 lets you use it as a manual screwdriver for that extra torque when you start or finish driving a screw.

Skil's 2305 screwdriver: Although slow at 130 rpm, it has a lot of torque.

Drills: A few suggestions before you buy

If we had to decide between a cordless drill, a driver/drill, and a screwdriver, we'd probably put a drill-only tool at the bottom of the list. Sure, some folks use these tools as screwdrivers, but that's not their best use. None of the consumer drills are true driver/drills with the control of an adjustable clutch.

Because consumer tools cost so much less than commercial tools, you might want to consider buying both a drill and a screwdriver for less than the price of one commercial tool. Having two tools eliminates continually changing from bit to blade.

Of all manufacturers, Makita has tried the hardest to accommodate folks who use their small, drill-only tools for driving screws. Since stalling the tool can burn out the motor, Makita has incorporated a manual circuit breaker to cut off power before the tool overloads. The Makita DA3000 DW right-angle drill is great in tight spots.

A recent addition to the drill lines of several companies is the cordless hammer drill (B&D, Hitachi, Makita, and Metabo). Hammer drills can perform as ordinary drills. Or, with the flick of a lever or dial, you can introduce a very fast, short forward and back strokes to the rotary motion (up to 27,750 blows per minute!). While not as useful to the home craftsman as driver/drills and screwdrivers, these tools make quick work of drilling holes in concrete, brick, and tile.

A couple of final tips about cordless drills: Be careful not to stall your drill. Since there is no clutch in a drill-only tool, stalling the tool drains the battery quickly and will shorten the life of the motor.

If you are going to drive screws or drill holes near the maximum capacity of the drill, two-speed models set in low gear, or high-torque/slow-speed tools, perform best. You have more time to react before you ruin anything.

At 27,750 blows per minute, cordless hammer-drills like this Metabo HD100/2 make short work of drilling holes in concrete and masonry.

Top to bottom: **B&D 9020, Makita 6010 SDW, Skil 2125. These consumer drills feature built-in battery packs.**

The Skil 2725 is one of the commercial models that comes equipped with an extra battery pack.

One battery pack fits all: The Makita 6710 DW screwdriver and the DA 3000 DW, the only right-angle cordless drill.

Continued

WHAT'S WHAT IN CORDLESS DRILLS AND SCREWDRIVERS

Manufacturer	Tool type	Model no.	Nickel-cadmium battery type**	Charge rate (S)tandard/(T)rickle/(Q)uick	Charging time (hr.)	Battery volts	Chuck type (G)eared/(H)ex shank	(M)echanical or (E)lectrical	Speed control: No. of speeds	Speed control: No-load rpm	Shaft lock (Y)es/(N)o	Clutch (Y)es/(N)o	Driver bits (P)hillips/(S)traight
AEG	D/D	EZ 505	R	Q	1	7.2	3/8 G	E	2	300/600	N	Y	P/S
AEG	D/D	EZ 506	R	Q	1	7.2	3/8 G	E	V	100–600	N	Y	P/S
AEG	S	EZ 502	R	Q	1	2.4	H	—	1	190	N	Y	P/S
Black & Decker*	D	1920	R	Q	1	9.2	3/8 G	—	1	1,850	N	N	N
Black & Decker	D/D	1940	R	Q	1	9.2	3/8 G	—	1	800	N	N	N
Black & Decker	D/D	1910	R	Q	1	7.2	3/8 G	—	1	600	N	N	N
Black & Decker	D/D	9020	B	S	3	7.2	3/8 G	E	2	170/400	N	N	N
Black & Decker	D/D	9021	B	T	21[2]	2.4	3/8 G	—	1	300	Y	N	P/S
Black & Decker	D/D	1970	R	Q	1	9.2	3/8 G	—	1	750	N	Y	P
Black & Decker	D/D	1980	R	Q	1	9.2	3/8 G	—	1	800	N	N	N
Black & Decker	S	2901	R	Q	1	9.2	H	—	1	1,500	N	Y	N
Black & Decker	S	2931	R	Q	1	9.2	H	—	1	750	N	Y	N
Black & Decker	H/D	5930	R	Q	1	9.2	3/8 G	—	1	1,850 rpm 27,750 bpm	N	N	N
Bosch	D	1920 RK	R	Q	1	7.2	3/8 G	M	2	300/650	N	N	P
Bosch	D	1920 VSRK	R	Q	1	7.2	3/8 G	M/E	2/V	0–300/0–650	N	N	P
Bosch	D/D	1921 VSRK	R	Q	1	7.2	3/8 G	M/E	2/V	0–300/0–650	N	Y	P
Hitachi	D/D	D6D	R	Q	1	4.8	1/4 G	—	1	320	N	Y	P
Hitachi	D/D	DTC-10	R	Q	1	7.2	3/8 G	M	2	280/700	N	N	P
Hitachi	D/D	DRC-10	R	Q	1	7.2	3/8 G	M	2	300/650	N	Y	P
Hitachi	D/D	D-10D	R	Q	1	9.6	3/8 G	M	2	300/1,000	N	Y	P
Hitachi	H/D	DV-10D	R	S	80 min.	9.6	3/8 G	M	2	750/1,500 12,000/24,000 bpm	N	N	N
Makita*	D/D	6010 DWK[4]	R	Q	1	7.2	3/8 G	—	1	600	N	N	P
Makita	D/D	6002 DWK[4]	R	Q	1	7.2	3/8 G	2	M	250/600	N	N	P
Makita	D/D	6010 SDW[4]	B	S	3	7.2	3/8 G	—	1	600	N	N	P
Makita	D/D	6012 HDW	R	Q	1	9.6	3/8 G	2	M	400/1,100	N	Y	P
Makita	H/D	8400 DW	R	Q	1	9.6	3/8 G	—	1	900	N	N	—
Makita	Right Angle Drill	DA3000 DW	R	Q	1	7.2	3/8 G	—	1	700	N	N	—
Makita	S	6710 DW	R	Q	1	7.2	H	—	1	220	N	Y	—
Metabo	HD	HD 100/2	R	Q	1	9.6	3/8 G	M	2	350/1,000 rpm 6,300/18,000 bpm	N	N	—
Metabo	S	550	R	Q	1	4.8	3/8 G	—	1	380	N	N	P
Metabo	D/D	D50	R	Q	1	4.8	3/8 G	—	1	150	N	N	P
Milwaukee*	D/D	0210-1	R	Q	1	9.6	3/8 G	M	2	350/750	N	Y	P
Milwaukee	D/D	0214-1	R	Q	1	7.2	3/8 G	E	2/V	100–600	N	Y	P
Milwaukee	S	6539-1	R	Q	1	2.4	H	—	1	190	N	Y	P/S
Porter-Cable	H/D	800	R	Q	1	9.6	3/8 G	M	2	350/1,000 rpm 6,300/1,800 bpm	N	N	—
Ryobi	D/D	BD-1020R	R	Q	1	7.2	3/8 G	M	2	300/600	N	Y	P/S
Ryobi	D	BD-102R	R	Q	1	7.2	3/8 G	M	2	300/600	N	N	—
Ryobi	D/D	BD-1025R	R	Q	1	9.6	3/8 G	M	2	350/1,100	N	Y	P
Sears	D/D	1116	B	Q	1	6	3/8 G	E	2	100/300	N	N	—
Sears	D/D	1112	R	Q	1	7.2	3/8 G	M/E	2/V	0–250/0–750	N	N	—
Sears	S	1120	B	S	3	3.6	H	—	1	130	N	N	P/S
Sears	D/D	27131	R	Q	1	9.2	3/8 G	—	1	800	N	N	N
Sears	S	27133	R	Q	1	9.2	3/8 G	—	1	800	N	Y	N
Skil*	S	2305	B	S	3	3.6	H	—	1	130	N	N	P/S
Skil TWIST®	S	2105	B	T	16[2]	2.4	H	—	1	130	Y	N	P/S
Skil	D/D	2125	B	S	3	3.6	3/8 G	—	1	230	N	N	—
Skil	D/D	2230-2	B	S	3	6	3/8 G	E	2	100/300	N	N	—
Skil	D/D	2323	B	Q	1	6	3/8 G	E	2	100/300	N	N	—
Skil	D/D	2520	R	Q	1	7.2	3/8 G	—	1	600	N	N	—
Skil	D/D	2725	R	Q	1	7.2	3/8 G	M/E	2/V	0–250/0–750	N	N	—

Tool type
D — Drill
D/D — Driver/drill
S — Screwdriver
H — Hammer/drill

Battery type
B — Built-in
R — Removable

*This company also offers several of these drills with or without cases and/or chargers using different model numbers.

rpm — Revolutions per minute
bpm — Blows per minute

V — Variable

Standard equipment					
	Bit storage (Y)es/(N)o	Charger (Y)es/(N)o	Case (Y)es/(N)o	Tool weight (lbs.)	List price
	Y	Y	N	2⅔	$139.00
	Y	Y	N	3	159.00
	Y[T]	Y	N	15 oz.	98.00
	N	Y	N	3⅛	174.00
	N	Y	N	3⅛	174.00
	Y	Y	Y	2½	141.00
	N	Y	N	2½	59.95
	Y	Y	N[3]	1½	54.95
	N	Y	Y	3½	188.00
	N	Y	Y	3½	184.00
	N	N	N	3	183.00
	N	N	N	3	183.00
	N	Y	Y	4	190.00
	Y	Y	N	2¾	139.00
	Y	Y	N	2¾	159.00
	Y	Y	N	3½	189.00
	N	Y	N	2.2	130.00
	N	Y	N	2.6	143.00
	Y	Y	N	3.3	159.00
	N	Y	N	3.5	185.00
	N	Y	N	4.9	185.00
	N	Y	Y	2.4	152.00
	N	Y	Y	2.6	154.00
	N	Y	N	2.1	84.00
	N	Y	Y	3.5	178.00
	N	Y	Y	3.7	188.00
	N	Y	Y	2.6	176.00
	N	Y	Y	2.4	148.00
	N	Y	N	4	195.00
	N	Y	N	2	159.00
	N	Y	N	2	175.00
	N	Y	N	3½	154.00
	Y	Y	N	2¼	154.00
	Y[1]	Y	N	14 oz.	84.00
	N	Y	N	4	195.00
	Y	Y	N	4	148.00
	N	Y	N	5	128.00
	Y	Y	N	6.1	168.00
	N	Y	N	2⅓	70.00
	N	Y	N	3¼	100.00
	N	Y	N	1½	40.00
	N	Y	N	3⅛	129.99
	N	Y	N	3½	139.99
	Y[1]	Y	N	1½	36.99
	Y[1]	Y	N	1	27.99
	Y[1]	Y	N	2	44.99
	N	Y	N	2⅕	50.99
	N	Y	N	2⅓	82.95
	N	Y	N	3¼	99.95
	N	Y	N	3¼	139.00

1 In-charger stand
2 After full discharge
3 Mounting bracket/holster
4 With overload protection

Up and coming cordless products

Cordless technology isn't limited only to drills and screwdrivers. Several new tools have been introduced in the past year and a half.

Three companies (B&D, Hitachi, and Makita) now have jigsaws in their cordless lines. And three companies (Hitachi, Makita, and Milwaukee) also offer cordless circular saws. Makita has manufactured a small 3⅜" circular saw for several years, but the new saws are powerful 6¼" and 6½" models capable of cutting 80 or more 2×4s with a single charge! Makita also has a ⅓-sheet sander, and other entries will debut in months to come.

Although these new types of cordless tools definitely are intriguing, we believe that drivers and drills make the most sense for the home workshop at this time.

Hitachi 6½" circular saw and B&D jigsaw are two of the new generation of cordless power tools.

Rechargeable batteries: Facts and fallacies

Perhaps the biggest misconception about today's rechargeable nickel-cadmium batteries is that they have a permanent "memory." Forget it! You do not need to charge and discharge your new tool two or three times before using it to prevent "memory" from limiting its capacity. You also can disregard advice about not charging your battery when it's only partially drained. The same goes for the old rule that you never stick the charger on for just a few minutes because "juicing up" the battery will cause it to lose capacity.

Now that we've told you what to forget, here's what to remember when it comes to getting the most from your battery pack, which actually consists of several 1.2-volt cells:

- Although using your tool in extreme heat or cold won't harm your power pack, you should let the battery cool or warm to the mid 70s before charging. Cells that are too cool or too warm cannot fully charge. Should this happen to you, try running the tool down completely and recharging for a complete cycle.
- It's wise to run a new tool down completely *once* before you charge it up to full power, but no permanent damage will result if you don't. Your new tool may not achieve full capacity for several cycles, but it will eventually.
- Watch for voltage depression in trickle-charge tools plugged in for months at a time with little or no use. If the tool quickly loses power during use, just discharge and recycle until the tool regains full power (after one or two cycles).

Photographs: Hopkins Associates

Anyone for DOMINOES?

You'll have as much fun building this set as you will playing!

Ever played one of the many variations of double-six dominoes? It's great fun—especially when you can say you made the set yourself. The 28 maple "bones" (playing pieces) fit snugly in a custom-fitted walnut box. It's a winning combination if ever there was one!

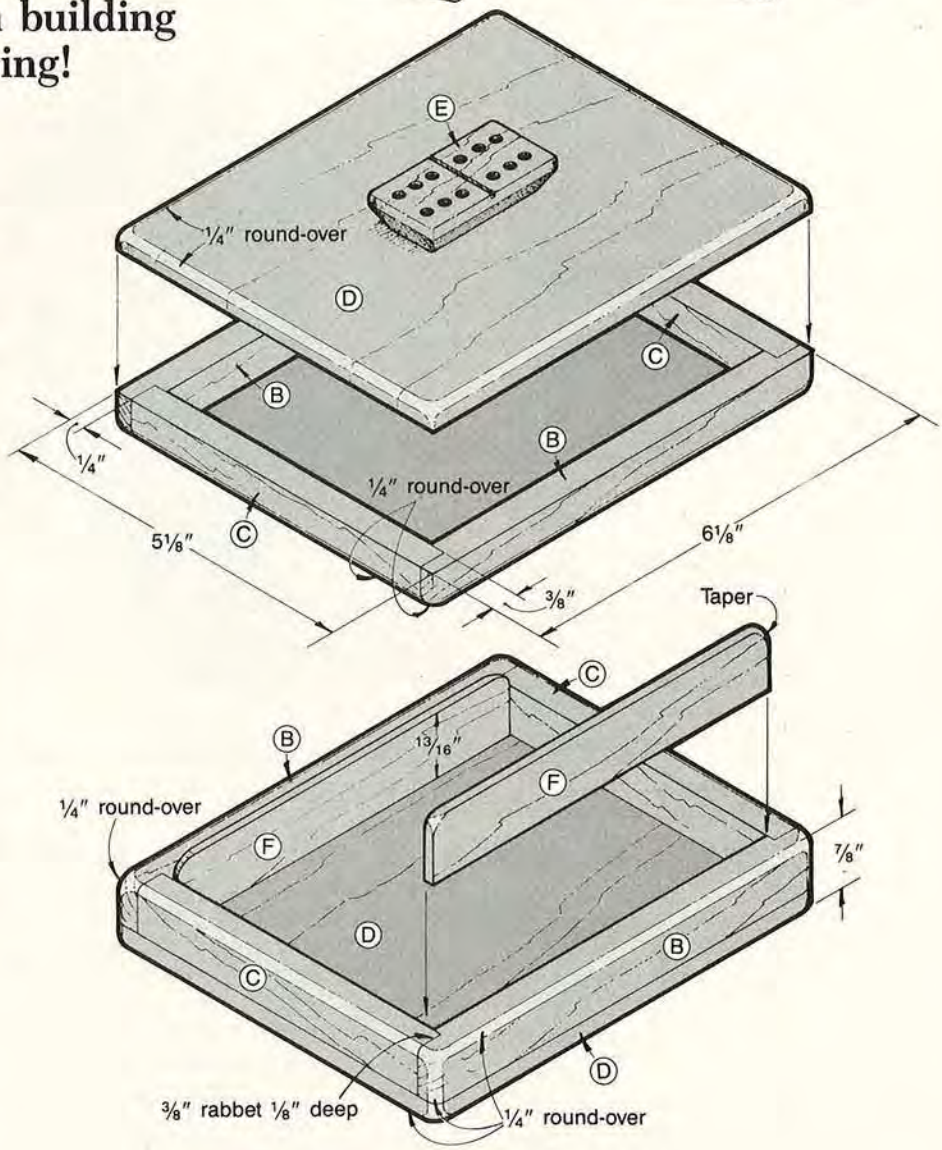
P.S. If you need to brush up on your domino rules, consult *Hoyle's Rules of Games* or *The Domino Book* by Fredrick Berndt at your library.

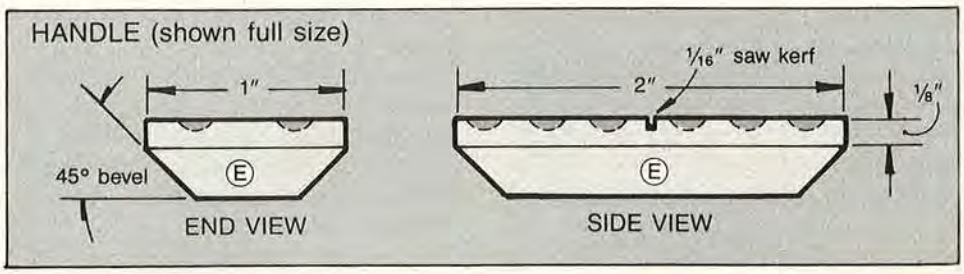
Note: You'll need some thin stock for this project. You can resaw your own or order it. See the Buying Guide on page 77 for our source.

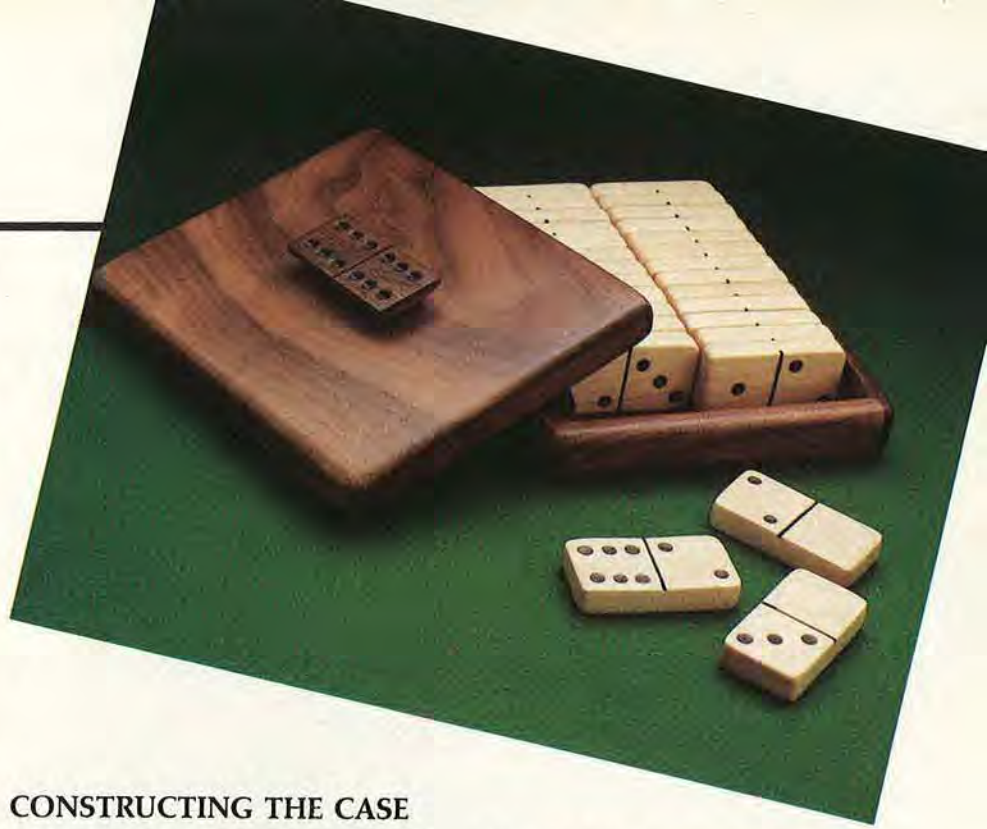
MAKING AND MARKING THE BONES

1 Rip and crosscut two strips of ¾" maple to 1" wide by 35" long. Resaw each strip on your table saw or band saw to obtain two ⅜" thick pieces (one ⅜" thick strip plus a waste strip from each 35" long piece). Using a stop block to guarantee consistency, crosscut the strips into 2" lengths to yield one set of bones (A). You'll have four extras in case you goof up one of the required 28 pieces.

2 Using a combination square, measure and then mark a line across the center of each bone. With a fine-toothed handsaw, carefully cut a 1/16"-deep kerf along each center mark. (We clamped each bone in a woodworkers' vise when cutting the kerf; a miter box would have worked equally well.)







Bill of Materials					
Part	Finished Size*			Material	Qty.
	T	W	L		
A*	3/8"	1"	2"	maple	28
B*	3/8"	1 1/4"	6 1/8"	walnut	2
C*	3/8"	1 1/4"	4 5/8"	walnut	2
D	1/4"	5 1/8"	6 1/8"	walnut	2
E*	3/8"	1"	2"	walnut	1
F*	1/8"	13/16"	5 3/8"	walnut	2

*Some parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: 1/4" hardwood dowel, tung oil or polyurethane finish, #0000 steel wool

3 Using the Full-Sized Pattern and Pip Configurations on page 77 as a guide, mark the location of the pips (dots) on the bones. (To avoid duplication, check off each bone listed on the Domino Numbering Sequence Chart as you complete it.)

4 Chuck a short length of 1/4" hardwood dowel in a drill press as shown, *below*. Start the drill press and sand a slight round-over on the bottom end of the dowel. Then, carefully "drill" with the dowel to emboss the pips onto the marked bones (the rotating dowel will burn a shallow depression in the maple bones). We used a back fence on our drill press to position the pips as uniformly as possible.

5 Sand a slight round-over on all four corners of each bone. Finish-sand the bones. (We marked the kerfs with a fine-tipped felt marker with mixed results; you may or may not want to mark the kerfs in your bones.) Apply several coats of tung oil or polyurethane. Rub lightly with steel wool between coats.

CONSTRUCTING THE CASE

Note: Assemble the case as a one-piece box, then cut it into two pieces to yield a perfectly matched lid and tray.

1 Resaw enough walnut for the 3/8" sides (B) and ends (C). Cut the sides and ends to the size listed in the Bill of Materials. Using a table saw with a dado blade, cut a 3/8" rabbet 1/8" deep on each end of the side pieces. (We pushed the pieces across the rotating dado blade with a miter gauge fitted with an auxiliary wood fence.)

2 Resaw enough walnut stock 1/4" thick to make the top and bottom (D). Then rip and crosscut the top and bottom to size. Glue and clamp the sides and ends together, checking for square.

3 Glue and clamp the top and bottom pieces (D) to the box. Sand the box smooth.

4 To cut the box in two, fit your band saw with a 6"-high auxiliary wood fence, 7/8" from the inside edge of the blade. Using a 1/4" fine-toothed blade, rip the box in two. (You also can cut the box apart on a table saw. If you choose this option, raise the blade approximately 1/2" above the surface of the table and cut through one wall at a time, making a total of four cuts.) Sand the cut edges smooth.

5 With a table-mounted router and a 1/4" round-over bit, rout all the edges of the tray and lid.

6 Rip and crosscut a strip of 3/4" walnut to 1×12", then resaw it to 3/8". Mark and emboss the pips for the double-six bone at one end of the walnut strip for the lid handle (E). Cut the handle to 2" finished length. Sand a 45° bevel on the edges and ends of the strip (see the Handle Side and End View Drawings). Be careful not to sand the tips of your fingers in the process! Cut the kerf in the bone. Sand the handle, and glue it on the lid.

7 From 3/4" walnut stock, rip a 1×12" strip, and resaw it to 1/8" thick. Rip and crosscut the 1/8"-thick strip to the dimensions listed in the Bill of Materials to make the two lid retainers (F). Sand a taper on the top outside edge of each retainer. Glue and clamp the retainers in the box, removing any excess glue before it dries completely.

8 Finish-sand the entire case, and apply the finish. Buff lightly between coats with steel wool.

Turn to page 77 for Sequence Chart, Full-Sized Pattern, Pip Configurations, and Buying Guide.

Project Design: Harry McManus
Photographs: Hopkins Associates
Illustrations: Kim Downing; Bill Zaun

WOODWORKERS' STANDARDS

SCREWS

Print this article

Specific standards govern just about every facet of woodworking, and screws are no exception to the rule. Here, in the second of our series on Woodworkers' Standards, we present a handy reference guide to fastening with screws. (For standards pertaining to seating and tables, see p. 54 of the February, 1986, issue of *WOOD*.)

What's there to know about screws, except that you never seem to have enough of the right kind when you need them?

After talking with fastener manufacturers, professional woodworkers, and the "always-has-the-answer" man at the hardware store, we may have some surprises for you.

We learned, for instance, about all the materials from which screws are made, and why you'd use one over the other; their different lengths and diameter sizes; head shapes and slot styles; and the importance of a correctly sized pilot hole.

And, if you've had it with digging through cans, jars, and bins to find just the right screws to finish your project, you'll also learn which ones you ought to keep on hand. Then, you can say good-bye to those minutes-before-closing dashes to your hardware store.

CHOOSING THE RIGHT SCREW BEGINS WITH THE METAL

Steel screws represent the least expensive and most common type available. They're strong, but like your car, they'll rust without protection. That's why steel screws normally have a shiny plating of cadmium or zinc chromate. Unplated screws start with a blue hue, but eventually oxidize to rust-brown.

When you need high strength *plus* corrosion resistance, opt for *stainless-steel* screws. You might have to special order them (your hardware store can do that), as well as pay double the price, but they'll hold up in outdoor furniture and high-humidity situations.

Steel *case-hardened* screws, originally developed for the manufacture of particleboard products, prove exceptionally tough because they've been heat-tempered. Case-hardened screws have a dull, flat-black finish and a skinny shank. They're used most often with a power screwdriver for driving into hardwood and particleboard. For projects exposed to the weather, you'll want them galvanized or plated, at, of course, higher cost. And, you might have to special order them.

With case-hardened screws, you can choose from two thread styles. *Double-leads*, or "hi-lo," have twin threads and work well in hardwoods. One-thread, *single-lead* styles are best for softwoods and particleboard because they hold. (See illustration at right.)

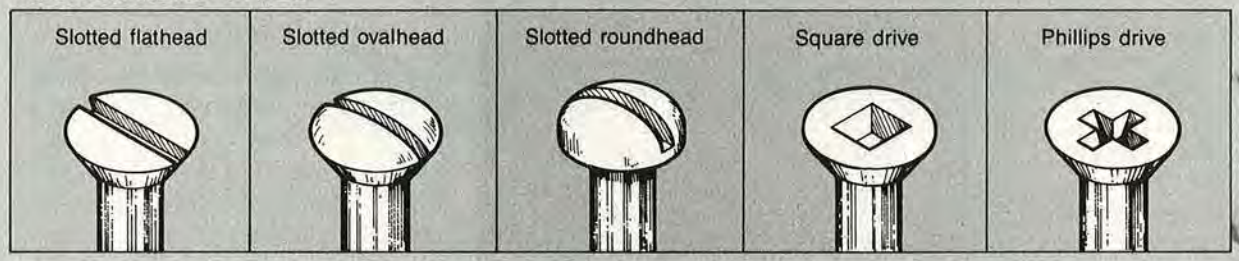
Brass screws can add a handsome accent when exposed, match hardware, or endure the elements. But, they're not as strong as steel and may twist off if you drive them into too small a pilot hole. Their slots will also wear if you use them in a situation where they'll be removed and reinstalled often. However, in projects calling for oak, which contains a tannic acid that reacts with ferrous metal, woodworkers normally choose brass to avoid unsightly staining.

Aluminum screws corrode quickly in contact with dissimilar metals and twist off easier than brass if you apply too much muscle. So, they're an unlikely choice for woodworking, *except* when your project demands aluminum hardware.

SORTING OUT SCREW SIZES

Compared to other materials and fasteners, screw sizes are a breeze to figure out. Their *gauge* refers to shank diameter in a range from #0 (the smallest) to #24 (the largest).

SCREW-HEAD TYPES



Gauge increases by .013″, or about 1/64″, in each increment.

Screw lengths begin at 1/4″ and reach 4″ or longer, though you'll probably stay in the middle range in your home woodworking. To cover all possible applications, each length comes in three or more diameters. As a rule, the smaller the gauge of the screw, the thinner the wood you should use it in.

HEAD STYLES YOU CAN DRIVE HOME

Just as screws of different metals work better in various materials or situations, different screw-head styles suit a divergence of woodworking needs and requirements. (See drawing, *above*.)

Choose *flathead* screws for general assembly, where you will countersink or counterbore the screw before covering with putty or plugs. When a flush surface isn't important, or when you want a decorative effect, *roundhead* screws fill the bill.

You use *oval- head* screws primarily to install hardware, such as cabinet hinges, because their shape matches the machined hole snugly.

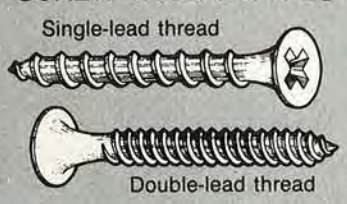
Besides differing head styles, screws also come in choices of drive slots to match your tools (again, refer to drawing, *above*).

The *straight-slot* fastens with a standard-tip or cabinetmaker's screwdriver mated to the width and thickness of the slot. This insures positive drive. A screwdriver too narrow and thin reduces torque and can mangle the slot, while one too wide mars the wood surrounding the hole and limits its drive depth.

Phillips-head screws have grown in popularity with the increasing use of the power screwdriver. With the cross-shaped slot, the driver tip self-centers in the head to lessen the chance of its slipping off to damage the workpiece.

The *square-hole* or "Robertson" type screw head goes the Phillips-head one better for positive, slip-free fastening. Developed for production work, this type requires a square-tipped driver (which you can buy separately to pop into your power driver).

SCREW-THREAD TYPES



HOW TO BUY SCREWS

Wood screws are generally sold by the box; those 4″ and shorter packed in quantities of 100. Screws over 4″ come in boxes containing 25 or 50, depending on their gauge and length. Most hardware dealers, of course, let you buy less than a box, but the individual price goes up.

If you have to order wood screws from your hardware dealer or mail-order supplier, you must specify the type of head, type of slot, length, diameter (gauge), material, and finish. Abbreviations, such as FH, RH, OH, refer to flathead, roundhead, and ovalhead screws.

Continued

WOODWORKER'S STANDARDS

SCREWS

SHOP REFERENCE GUIDE
(Screws shown are actual size)

TYPICAL USES	ATTACHING SMALL HARDWARE					GENERAL ASSEMBLY			HEAVY-DUTY ASSEMBLY			GENERAL ASSEMBLY W/POWER DRIVER		
GAUGE	2	3	4	5	6	7	8	9	10	12	14	6	8	10
HEAD BORE SIZE	11/64"	13/64"	15/64"	1/4"	9/32"	5/16"	11/32"	23/64"	25/64"	7/16"	1/2"	5/16"	11/32"	11/32"
SHANK DRILL SIZE	3/32"	7/64"	7/64"	1/8"	9/64"	5/32"	5/32"	11/64"	3/16"	7/32"	1/4"	1/8"	5/32"	3/16"
PILOT DRILL SIZE	1/16"	1/16"	5/64"	5/64"	3/32"	7/64"	7/64"	1/8"	1/8"	9/64"	5/32"	3/32"	7/64"	9/64"

AVAILABLE LENGTHS—SHORTEST TO LONGEST (INCHES)

1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/4, 2 1/2, 2 3/4, 3, 3 1/4, 3 1/2, 3 3/4, 4

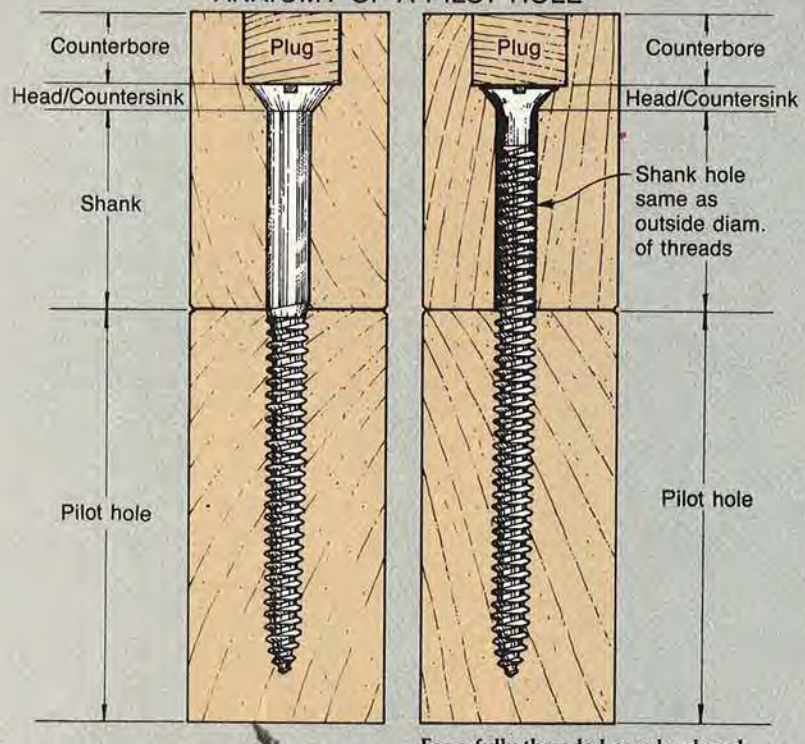
THE PILOT HOLE: TIGHT, BUT NOT TOO TIGHT

Think of a pilot hole as a custom-fitted binocular or gun case. As you can see in the drawing *below*, it grips every contour of the screw, allowing the threads to bite and hold in the wood.

Forget the widespread belief that a pilot hole has to be one size smaller than the screw—this often results in split wood. When you drill a pilot hole, you're guided by the screw's dimensions: its length, the diameter of its shank, pilot (less threads), and head (for countersinking, or counterboring, if a plug will be used). The easiest way to accomplish this is with a *screw pilot*, which drills all parts and configurations of the hole in one operation. Real time-savers, they're available to match common screw sizes (some screw pilots are adjustable for different lengths).

Some types of case-hardened screws, designed for rapid assembly of cabinets, have special auger points that bore into the wood as they're driven in place with a power screwdriver. Their tempered toughness allows them to resist twist-off, and they actually store chips in their shank as they bore (this eliminates heat buildup). Even with all their driving power, auger-point screws may still require pilot holes in end or edge grain, and that presents a hitch: To our knowledge, screw pilots aren't available to match case-hardened screws, so you have to change bits for the two-step operation. Or, use a drill bit with a countersink attached.

ANATOMY OF A PILOT HOLE



For a fully threaded case-hardened screw, above, drill a shank hole as you would for a normal screw or it won't draw up.

ON USING SCREWS

Assembling a project with screws can be quick and hassle-free, if you heed this advice from our shop:

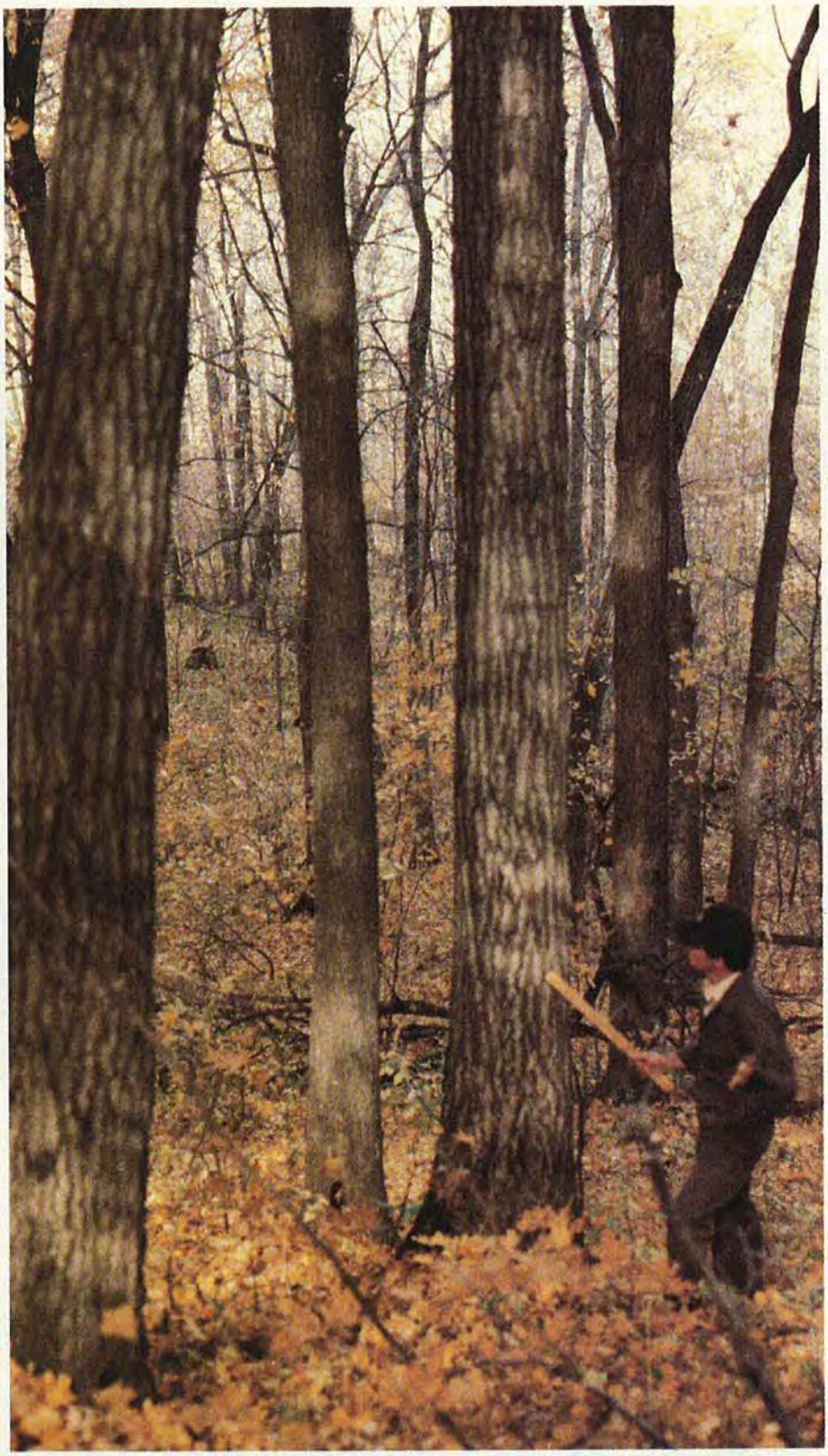
- Always lubricate screws before inserting them. Of all we've tried, beeswax works best for us.
- Drill a test hole for the size screw you intend to use. To make it smaller or larger, change bits in 1/64" or 1/32", not 1/16", increments.
- Brass screws are naturally softer, so the pilot hole should be roomier to prevent twist-off.
- Case-hardened screws hold, but those with completely threaded shanks can't pull pieces together. To assemble with this type, you have to tightly position the pieces *first*.
- Keep an assortment of screws on hand. Here are some sizes for general assembly: Flathead screws in #6×1"; #8×¾", 1", 1¼", 1½", 2"; and #10×1½". Case-hardened screws in #8×1⅛" and #10×1¼", 1¾", 2", 3".

Produced by James R. Downing with Peter J. Stephano
Illustrations: Randall Foshee; Bill Zaun

TIMBER

How the pros size

Ever wonder what furniture- and cabinet-quality hardwood lumber and veneer look like in the woods? We did, and we decided to send Features Editor Peter J. Stephano out with a forester for a hike in the hardwoods. Here, in Peter's report, you'll learn why one tree can be worth a king's ransom, while its neighbor rates no better than the woodpile.



Scaling stick in hand, District Forester Gary D. Beyer of the Iowa Conservation Commission, checks a walnut tree for a spider crack.

A telephone call last autumn put me in touch with Gary D. Beyer, a District Forester with the Iowa Conservation Commission. I wanted to find some quality hardwood on the stump. Gary said some of the finest walnut anywhere climbs the slopes of the rolling hills that drop off to the meandering Mississippi River north of Dubuque. He agreed to be my guide on a timber "cruise," a walk through the woods to explore timber quantity and quality.

It's in the forest that trees begin the long process that ends in your workshop. The many stages, and hands, that hardwood passes through on its way to your shop represents but a fraction of a tree's lifespan. It takes a minimum of 50 years for a walnut to reach minimum logging size of about 16" in diameter, and even then not all make the grade.

Foresters like Gary Beyer spend lots of time cruising to provide landowners with an estimate of board-foot volume and marketable quality their standing timber, called *stumpage*, will yield. In the woods, the forester examines each tree, records its size and condition, then marks those to be logged.

When cruising, the forester carries a *scaling stick* to calculate tree girth, height, and the approximate

Print this article

CRUISING

up fine stock on the stump

board feet in the tree. But only through experience can he see the signs that make one hardwood tree better than another.

FOR GOOD HARDWOOD, LOOK TO THE NORTH SLOPE

Gary and I met at the Volga River ranger station, with its view of the undulating countryside. "What would you like to see?" Gary asked. "I can take you to red oak, walnut, or mixed stands." He motioned to his scratched and muddied four-wheel drive Blazer as I replied "Walnut!" without hesitation.

Quality hardwood doesn't grow equally well everywhere. Trees depend on soil nutrients, moisture, and climate for their existence—and every species has different demands.

Even within a geographical region, some conditions prove better for quality hardwood than others. For instance, choice white oak, red oak, and walnut originate throughout the stream-laced hills of southeastern Minnesota, southwestern Wisconsin, and northeastern Iowa.

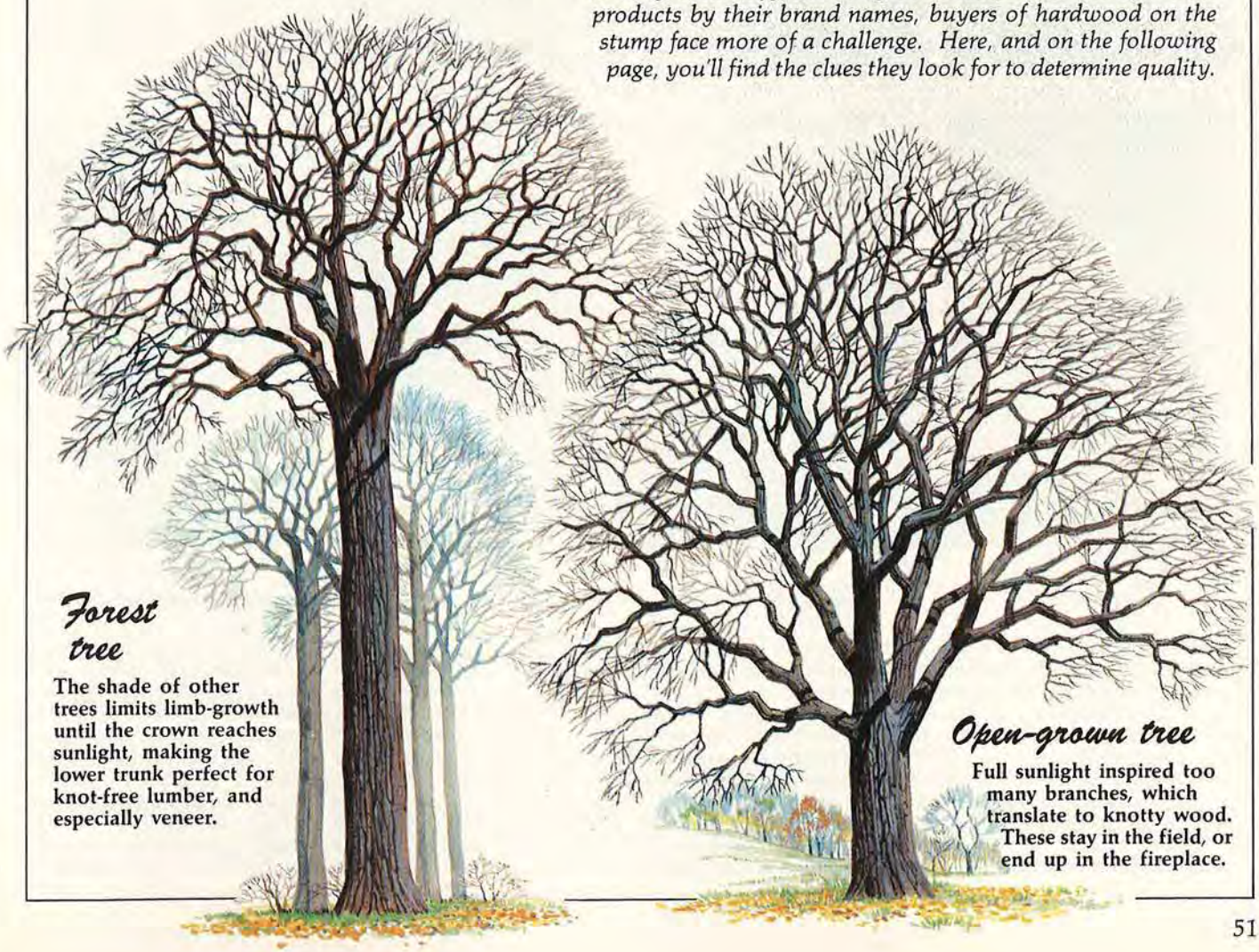
There, you'll find the best-quality trees anchored in the humus-covered bedrock of north-facing slopes where moisture clings and coolness reigns. And foresters as well as hardwood buyers place greater value on trees from a forest setting.

"That's because a forest hardwood, such as walnut, self-prunes," Gary informed me. "In the shade provided by other trees, lower branches either don't develop or dwindle off when the tree is sapling-size. The result is a tree without knots for a long distance, or with knots only deep in the

Continued

Finding fault with hardwoods

While you identify books by their covers and manufactured products by their brand names, buyers of hardwood on the stump face more of a challenge. Here, and on the following page, you'll find the clues they look for to determine quality.



Forest tree

The shade of other trees limits limb-growth until the crown reaches sunlight, making the lower trunk perfect for knot-free lumber, and especially veneer.

Open-grown tree

Full sunlight inspired too many branches, which translate to knotty wood. These stay in the field, or end up in the fireplace.

Finding fault with hardwoods

Bird peck

Deduct bucks from a tree's potential value when you see these punctures made by birds such as sapsuckers. Holes in the bark shelter fungus, which causes decay or stain in the wood. You'll find them in one concentrated area, or scattered around the tree. Often, bird peck will completely encircle the trunk of the tree.

Cat face

No matter how faint, these little faces peeking out from the bark indicate lost limbs. There will always be knots under them when the log is sawn, so value drops. Limbs shaded off early in the tree's life leave their trace only deep in the innermost 6" to 8" of heartwood, with no visible evidence in the bark. No cat face in evidence, no loss.

Pimples

When a forest tree (white oak in particular) suddenly gets sunlight, as when its neighbors are felled, limb buds erupt, creating small bumps in the bark. Large, well-defined pimples extend deep into the wood, disrupting grain and discounting value. Tiny pimples can be sawed off when the log is squared off during milling.

Spider crack

Crawling across the bark at a tree's base, this crack may be a check into the very heartwood. If so, loggers have to cut above the crack, losing several valuable feet of veneer or sawlog. Because you can't tell how deep the crack is until it's felled, bet on reduced price. Buyers only pay for what they get, and they don't care to gamble.

Bark scar

Scars take many forms, but all mean there's possible damage underneath in discoloration or decay. Don't expect top quality from scarred-up timber. When an unbroken scar runs from top to bottom of the trunk, a lightning strike could have cleaved deep into the heartwood. Scraped-away bark at the base is an abrasion, with a bruise.

Cherry bark

Healthy walnut bark is dark brown and deep-furrowed, indicating slow, but steady growth. When bark resembles that of the wild cherry tree, the growth has been nearly stagnant, and the tree often turns out hollow. You may not be able to tell a good book entirely by its cover, but a log buyer can pick top walnut by what it's wearing.

Swirling bark

Even foresters aren't sure what causes bark to twist up and around a tree rather than go straight up and down, but they do know the grain will be twisted, too. Whether caused by wind as the tree grew, or genetics, swirling bark means crooked, intertwining grain and terrible lumber and veneer. As the bark goes, so does the price.

Sweep/oblong trunk

You can't saw a straight log of any length from a tree with sweep. Bowed trees are discounted. And most trees with sweep also have oblong trunks with off-center heartwood which is difficult to saw or veneer. Somehow, nutrients weren't distributed evenly. Gravity may have been the culprit, but the owner's at loss.

heartwood—the rest is clear.

"You'll see what I mean in a minute," Gary said, shifting our vehicle to low gear for the crawl up the rutted lane ahead. He swung the Blazer into a small clearing. Below were fields and pasture dotted with trees. Behind, woods ascended the slope.

"There's open-grown walnut," Gary said, and pointed. My eyes followed to the pasture below, and the lone tree he sighted. "See all the low, heavy branches?" the forester asked. "You won't find much knot-free lumber in that walnut. It's good only for someone's fireplace. Now, let's look at some super timber." He grabbed his scaling stick. I followed him into the trees.

DETERMINING A TREE'S VALUE: KEEP YOUR EYES BELOW THE FIRST FORK

Interspersed among prime hardwood trees in the forest, you'll almost always find one or several with faults that knowing eyes discern as lower-value lumber.

To understand why some faults affect a tree's price on the stump, you need to know some basic logging economics. In hardwood, 90 percent of the tree's value lies in the first 16′ or so of the trunk, *if* it is defect-free.

What the pros call *merchantable height* is measured from the base to the first defect, to the major fork if there isn't a defect, or to where the trunk diameter diminishes to 10″ in absence of a fork or defect. The greater this height, the greater the tree's worth, because foresters use the merchantable height and the tree's diameter 4½′ above the ground, called *d.b.h.* or *diameter breast height*, to figure the approximate number of board feet it contains. They accomplish this with conversion tables based on *Scribner rule* (the logger's equivalent of the gold standard), or other volume tables. The table, *below left*, shows you how to estimate board feet in the woods.

"Lots of these will go for veneer because they're so straight and limbless," Gary informed me as we continued tramping through the leaves. How much veneer did these trees represent? "That's real hard to say because there's no tried-and-true way to estimate it," Gary answered. "There are many ways to slice veneer, and each method can produce a different thickness, or make use of a tree in a different way. So, it's all up to the buyer and how he'll use it. You can only guess about veneer."

PRICING TIMBER ON THE STUMP

"What a buyer pays for a tree depends on what they can or can't see is wrong with it for their special market. Not every buyer will agree, but there are some visible defects that should lower the price of some of these walnut trees. I can grade them by cruising, but I can't tell you what they're worth. One buyer might pay $4 a board foot on the stump. Another might only go $1.50. In the woods, trees have no set prices," Gary remarked.

That means one tree could bring $1,500 or more, while another of lesser quality would sell for a third of that price. Timber's value at any given time is as much as the highest bidder wants to pay.

Gary scrutinized every tree as if he were a jeweler examining gemstones. I soon learned to look closer at the trees, too, and spot what he had made clear to me—the telltale flaws, the signs of fine hardwood. In the photos and drawings on these pages you'll share in what I learned among the hardwoods. Believe me, your woodworking hobby means more when you know your raw material. Have fun picking out the winners and losers on the stump next time you're out in the woods!

Produced and photographed by
Peter J. Stephano
Illustrations: Jim Stevenson

Just for fun: How you can estimate board feet on the stump

In the woods, foresters use a scaling stick to determine a tree's possible yield. With it, they can calculate trunk height through triangulation, a method in trigonometry that uses two known distances in a triangle to find the third. Then, they consult a table similar to the one below to estimate board feet. Without a scaling stick, you can come close by following this procedure:

Step 1. Estimate merchantable height by visualizing yourself standing against the trunk. Then, back off about fifty paces from the tree and look at it. Imagine how many times you can multiply your height, in feet, up to the first defect, fork, or narrowing of the trunk to 10″ in diameter.

Step 2. Measure the trunk circumference at breast height (about 4½′) with a steel tape.

Step 3. Find the diameter that corresponds to the circumference on the chart below and read across to find the tree's board foot volume.

Circumference at breast height (inches)	Diameter at breast height (inches)	Merchantable height (feet)					
		8	16	24	32	40	54
		Yield in board feet					
57	18	72	122	168	207	248	292
63	20	90	156	212	262	317	366
69	22	111	194	262	328	392	450
75	24	137	236	319	400	470	550
82	26	165	281	381	480	565	650
88	28	195	331	450	560	670	760
94	30	227	383	520	650	770	890
101	32	260	440	600	740	890	1,020
107	34	294	500	680	840	1,010	1,160
113	36	330	565	770	960	1,140	1,310

POWER DRILL BITS & BORING TOOLS

In woodworking projects, you often spend as much time removing wood to make holes as you do joining it together. And for every hole you want to make, you have a choice of several drill bits or boring tools for precisely that job. In fact, you could probably more than fill a big toolbox with all of your alternatives.

Fortunately, you don't need that complete of a selection to get the job done properly. That's why we compiled the chart at right. It illustrates and describes what each of the most common bits and boring tools is designed to do. These range from basic twist drills and spade bits through the precision bits to tools that can cut large holes when you need them.

For more tips on using these can't-do-without workshop helpers, see the article on page 87 of this issue.

Illustrations: Greg Roberts

GENERAL DRILLING AND BORING

Twist drills are inexpensive and drill equally well in wood, plastic, and metal. For this versatility, these drills normally have tips ground to an angle of 118°, which, unfortunately, also makes them wander when you start a hole in wood. For easier and more accurate starting in wood, you can order twist drills ground to about an 80° angle (check advertisers in this issue for sources). However, this angle wears down quickly in metal.

Because the spiraling flutes on twist drills run close together, they don't extract chips from the hole very well and can clog up and burn the wood. Avoid this by backing them out occasionally. Be careful, too, when you reach the bottom of a hole—twist drills tend to split wood away from the back of the workpiece on a through-hole, even when you use a backing block.

Twist drills are available in diameters

PRECISION DRILLING AND BORING

Auger bits drill deep, accurate, flat-bottomed holes quickly, even in end grain. However, you can only use auger bits with a straight shank (i.e., without a tang) for power drilling. You can remove the tangs of brace-type auger bits for use with a large portable electric drill or drill press, but drilling can't exceed 200 rpm because of the threaded tip.

Manufacturers do, however, offer auger bits with straight shanks for power use, with either a centering, threadless brad point or "barefoot" without a point. Pointless augers drill straighter because they won't follow deviations in grain, but you can use them *only* in a drill press.

Auger bits also come in two body styles. Solid-center bits, such as the one at right, have one flute spiraling around a center shaft. Fluted types have two spirals resembling a curly ribbon, and have no center shaft. These bore a smoother hole than solid centers, but they cannot extract chips as well. Both types are expensive and come in diameters from ¼" to over 1". Sizes are indicated this way: A no. 12 is 12/16" or ¾".

Multispur bits saw with a rim of jagged teeth to cleanly cut a smooth, flat-bottomed hole. Guided by a center point, they can bore through veneer without tearing it and can make overlapping holes.

Use multispur bits only in the drill press, with the stock clamped. If you don't, their twisting power will throw the stock. Multispurs are moderately expensive and range from ½" to 4⅝" in diameter.

Forstner bits cut with their circular rim, and thus are the *only* bit that can cut any portion of a hole's diameter on the edge of a board. However, they won't bore as deeply as a multispur bit. True Forstner bits are intended for use in wood only, but you'll find variations of this bit, occasionally with carbide-tipped cutting edges, that also bore flat-bottomed holes in wood, as well as plastic laminates.

Designed to bore at 1,000 rpm or

LARGE-HOLE BORING TOOLS

(For holes 3" or larger in diameter.)

Expansion bits have a sharp lead-screw point and an adjustable-spur arm for cutting somewhat smooth, deep holes from ⅝" to 5" in diameter. A setscrew locks the horizontal, sliding cutting arm in place.

Circle cutters, often referred to as *fly cutters,* adjust to cut holes in thin stock from ⅝" to more than 8" in diameter. Use them only in drill presses at a maximum of 500 rpm.

Stock that you will cut with a circle cutter must be firmly clamped to the drill press table. Since the depth of the cutter is limited, you may have to flip the stock when the hole has been cut partway through and complete the cut from the opposite side.

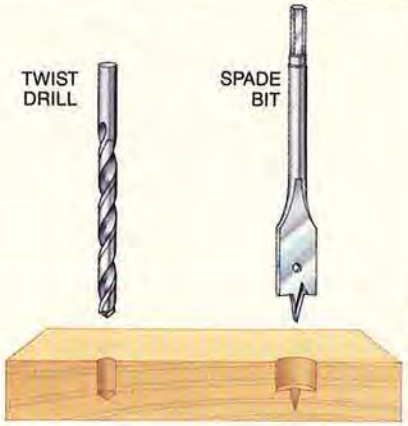
Hole saws combine an arbor assembly with a centered twist drill and a

Print this article

from 1/64" to 3/4", increasing in 1/64", 1/32", or 1/16" increments. You'll also find them in diameters to match wire gauges, in millimeter sizes, and in a variety of lengths. For best results, use twist drills at high rpm to drill holes no larger than 1/2".

Spade bits bore flat-bottomed holes with an added tapering hole in the bottom from their long centering point. The sides and edges of the hole they bore often are slightly splintered and chipped. Since spade bits don't extract chips well, don't use them for deep holes or heavy cutting—they heat up quickly.

Designed for use in wood only, but not cabinet-work, spade bits can drill at angles, too. Sizes range from 1/4" to 2" in diameter. Spade bits normally come only in carbon steel. They're easily sharpened and inexpensive. Never use them at high speeds.

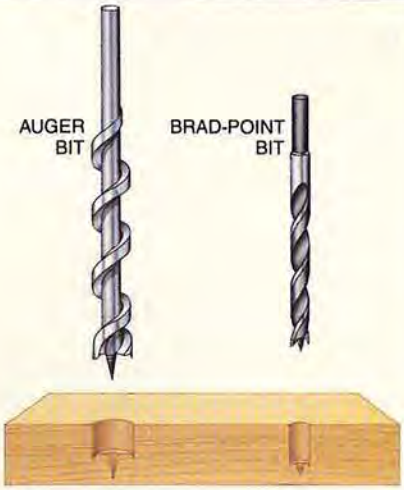


Brad-point bits replace the common twist drill in woodworking. They're often called "dowel drills" because woodworkers use them to make dowel holes. These drills have a sharp centering point (the "brad") to guide, and a cutting spur on each edge of the bit to shear the wood for flat-bottomed holes. Two flutes extract chips.

Thanks to their well engineered design, brad-point bits won't wander when you begin drilling a hole as a twist drill does. They also cut much more smoothly for a comparatively moderate price.

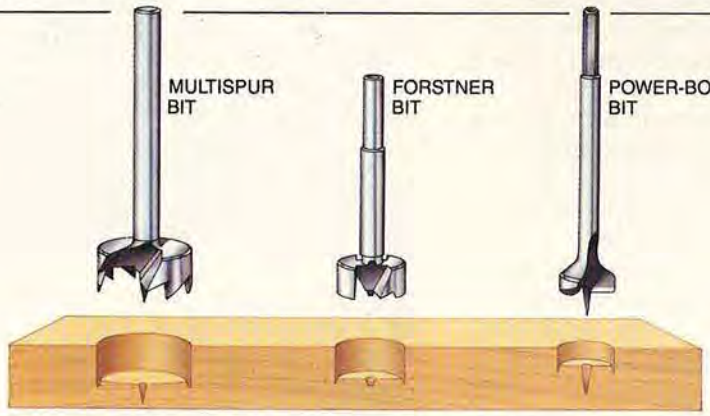
Watch where you're drilling with a brad point, though. Hitting nails or screws severely damages any type of bit, but with a brad point, the damage is devastating. It's a real task to reclaim the point and the spurs by resharpening.

Brad points usually come in sizes from 5/64" to 3/4", increasing by a tiny 1/32", but larger diameters are available. You should limit their use to holes no larger than 1/2" in diameter, but a well-machined bit can drill larger holes without heating up and losing temper if you slow down the feed rate.



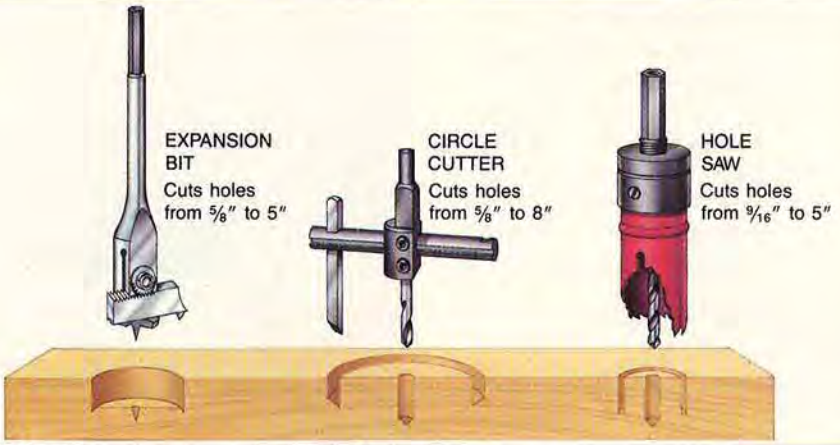
less, the rim of a Forstner polishes as it cuts. Fairly expensive, these bits come in diameters from 1/4" to 2".

Power-bore bits are a relatively inexpensive alternative to multispurs or Forstners. They use a brad point to guide and one cutting spur to bore clean holes fast. Don't use them for deep holes because they can't extract chips. You'll find power-bore bits in diameters from 3/8" to 1".



sawlike cutting unit to bore rough holes in wood, plastic, and metal. The teeth produce sawdust rather than chips, requiring you to back the tool out of the hole occasionally to clean buildup from the cutting edges. The plug removed resembles a wheel.

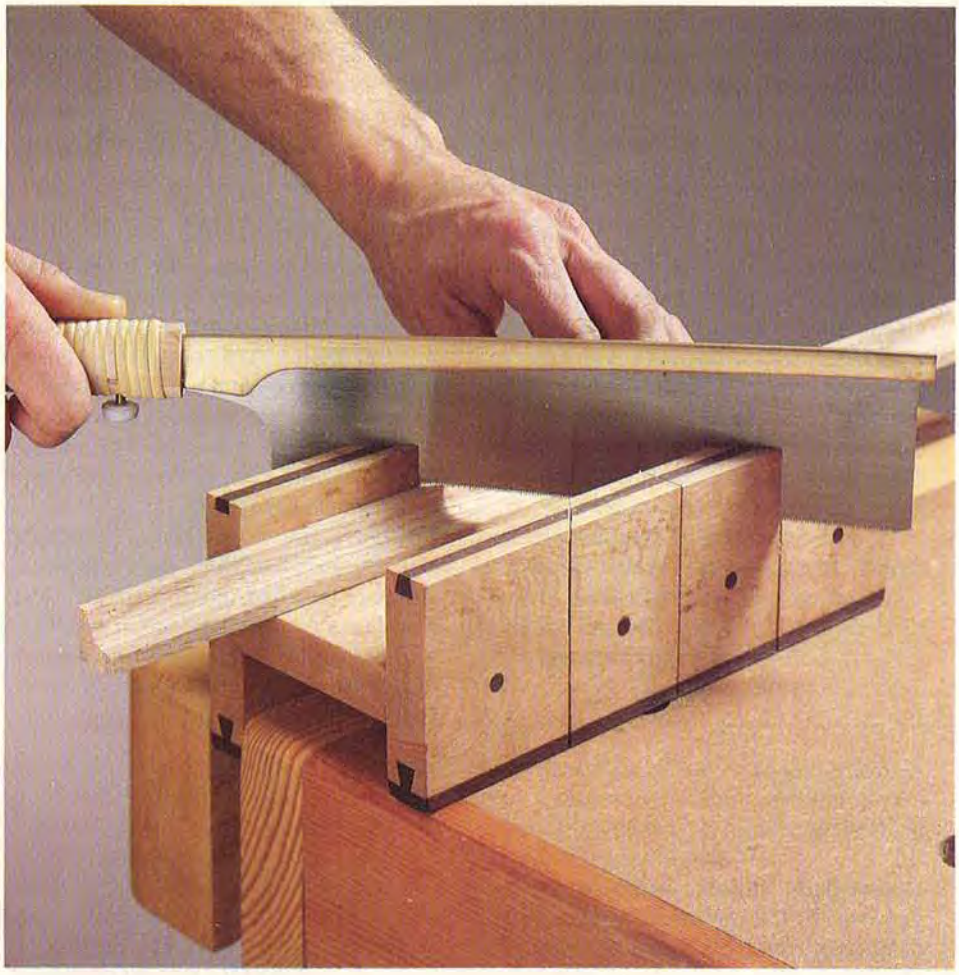
You can interchange sizes from 9/16" to 5" on the arbor. Large-diameter holes call for a drill press (or two-handled commercial drill) and slow rpm. Always clamp the stock down.



You can count on this one!

Tried & True MITER

Note: Your miter box will be only as accurate as the saw cuts you make. Cut scrap stock and check the angles before starting. Also, keep the distance between the front and back fence at exactly 3".



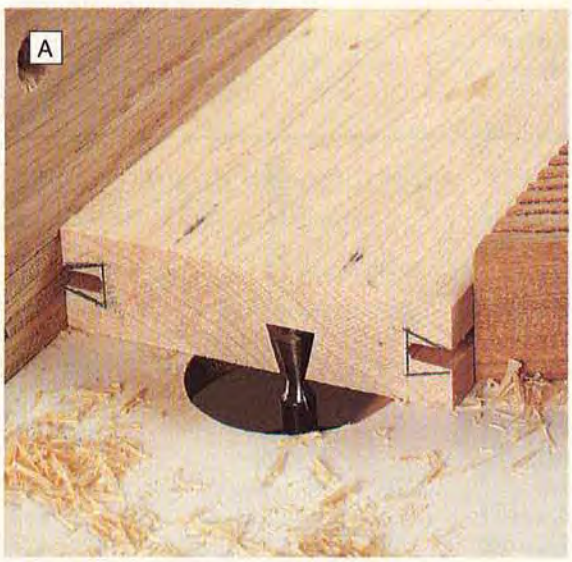
CUTTING THE PIECES

1 Cut the maple front fence (A) and back fence (B) to the sizes listed in the Bill of Materials plus 1" in length, making sure the cross cuts are square. Cut the base (C) to size, and two pieces of ¾" walnut to 2" wide by 11" long for D and E.

2 Measure and mark the position of the six dovetail grooves on the front and back fences. Using a table saw and a ⅛" blade, cut a kerf down the center of the marked dovetail grooves (see photo A). This removes most of the wood needed to form the dovetail grooves. (We found that routing a dovetail groove without first cutting the kerfs can make the router bit wander or burn the wood.)

3 Fit your table-mounted router with a 13/32" dovetail bit (see the Buying Guide for information). Attach a fence and featherboard to the router table as shown in photo A. With the top of the bit ⅜" above the table surface, cut the dovetail grooves in both fences (A, B), making one pass through the previously cut saw kerfs.

4 Reposition the fence, but not the cutting height of the bit. Cut the tongues in the center of the edges of C as shown in photo B; then rout the edges of the walnut blanks for strips D and E where shown in the Walnut-Parts Drawing. (We cut the tongues slightly oversize at first, and moved the fence closer to the bit until the tongues fit snugly.)



CUTTING THE FENCE INTO SECTIONS

1 Using a stop block, make miter cuts no. 1 and no. 2 on each end

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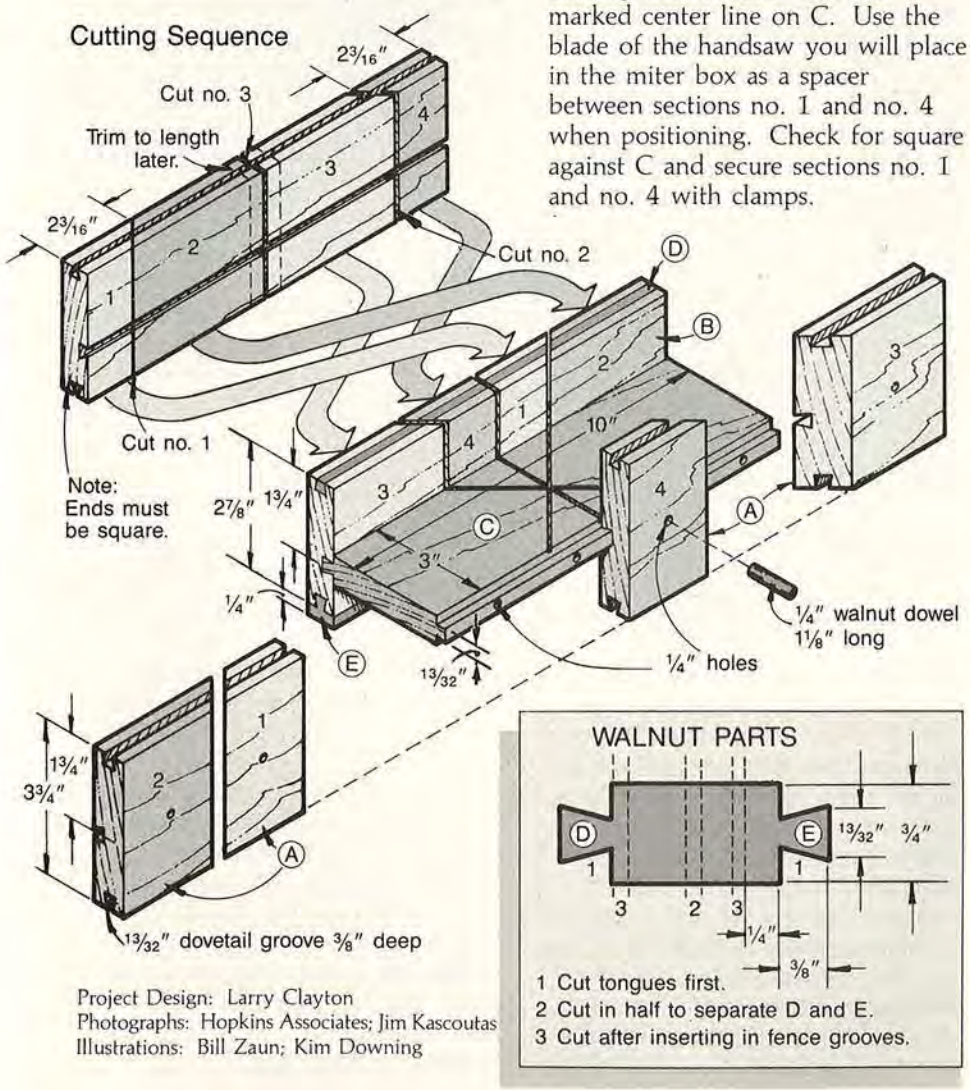
BOX

By making the critical cuts on the table saw before assembly, you guarantee that this homemade miter box will deliver power-tool accuracy when you hand-cut the smallest of parts.

Bill of Materials					
Part	Finished Size*			Material	Qty.
	T	W	L		
A*	3/4"	3 3/4"	10"	maple	1
B*	3/4"	2 7/8"	10"	maple	1
C	3/4"	3 3/4"	10"	maple	1
D*	13/32"	3/8"	10"	walnut	2
E*	3/4"	5/8"	10"	walnut	2

*Parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: 1/4"-diameter walnut dowel stock, polyurethane



Project Design: Larry Clayton
Photographs: Hopkins Associates; Jim Kascoutas
Illustrations: Bill Zaun; Kim Downing

of both fences (A, B) where shown in the Cutting Sequence portion of the Exploded-View Drawing. To facilitate positioning later, mark numbers in pencil on the maple sections where shown in the drawing.

2 Make cut no. 3 in the center of each fence to form sections no. 2 and no. 3.

ASSEMBLING THE MITER BOX

1 Mark a line at 90° across the center of the base (C). Glue and slide sections no. 1 and no. 4 of both fences onto the tongues of C. Line up the sections with the marked center line on C. Use the blade of the handsaw you will place in the miter box as a spacer between sections no. 1 and no. 4 when positioning. Check for square against C and secure sections no. 1 and no. 4 with clamps.

2 Slide (but do not glue) sections no. 2 and no. 3 onto the tongues of C, again using the saw blade as a spacer. Mark the ends of sections no. 2 and no. 3 against the finished length of C (sections no. 2 and no. 3 are still cut long at this point). Slide sections no. 2 and no. 3 off, and trim to length. Now, glue and clamp sections no. 2 and no. 3 into position on each fence, again using the blade of the saw as a spacer, and checking for square.

3 Rip parts D and E in half to obtain four long pieces, each with a tongue where shown in the Walnut-Parts Drawing. Glue and slide parts D and E into the dovetail grooves in the front and back fences.

4 To further secure the sections in position, drill a 1/4" hole 1" deep in each section of A and B (eight total holes) into the center of the edges of C. Cut eight pieces of 1/4" walnut dowel stock to 1 1/8" lengths; then glue and drive the dowels into the holes. After the glue dries, trim and sand the dowels flush.

5 Trim off the excess from the ends of the walnut strips (D, E). Now, using the fence on your table saw, trim the protruding top edges of each D and E to finished size, where dimensioned in the Walnut Parts Drawing.

6 With the same handsaw used earlier, cut through the walnut into the previously cut kerfs in both fences. Finish-sand the miter box and apply two coats of polyurethane.

BUYING GUIDE

● *13/32" dovetail bit.* Kromedge bit, Sears catalog no. 9HT25539, $5.49.

● *Dozuki saw.* Catalog no. 49117.01, $27.95. Garret Wade, 161 Avenue of the Americas, New York, NY 10013. Order by calling 800-221-2942.

DOES FLECTO'S NEW ONE-DAY WOOD

WE JUST HAD TO FIND OUT!

We get lots of mail at *WOOD*, and no topic triggers more questions than finishing. What's the best grit for finish-sanding? How do you choose among oil, lacquer, varnish, or polyurethane? What about fillers and sealers? To help close the knowledge gap, we'll be evaluating finishing products and techniques from time to time in articles such as this.

Print this article

All too often, putting the finish on a woodworking project turns out to be another tunnel at the end of the tunnel. After you've carefully cut and assembled all the pieces and sanded everything to perfection, it's time to think about staining.

You wait overnight for the stain to dry and apply the first coat of finish. Then, another day for the second coat, yet another for the third—plus a fourth day before the final coat dries.

Accustomed to devoting the better part of a week to finishing, we were intrigued by the claims for Flecto's Varathane one-day finishing system. According to the product literature, you can wipe on stain at 9 a.m., apply three coats of polyurethane varnish at two- to three-hour intervals during the day, and the piece will be ready for use at about 9 p.m. From bare wood to your living room in just 12 hours? It sounds too good to be true. We decided to test the system.

The Varathane system comes in two cans—a wood toner/stain and a fast-drying clear finish. Both are polyurethanes. The stain, available in six hues, is an emulsified type. (Emulsified stains penetrate the wood to some extent, but also leave a film on the surface that slightly masks the wood grain. Oil-, water-, and alcohol-base stains, in contrast, penetrate deeply into the grain and leave virtually no film on top.) With the clear finish you can choose from either a gloss, semi-gloss, or satin patina.

PUTTING IT TO THE TEST

For our test, we tried two hues and all three patinas on samples of pine, birch, and red oak. Because oak has a very open grain we chose to fill several of the oak samples with a paste wood filler. All the *un*filled samples came through with flying colors, but the filled pieces were a far different story.

We began with the pine. Because of pine's porosity, we considered this one the acid test. After wiping on the stain, we waited five minutes, then wiped it off. The stain passed muster just fine: There was no blotching, and it didn't raise the wood's grain.

Next came the birch. Because it's a semihard wood and we wanted all the samples to come out the same color, we let it set for 10 minutes before wiping. That was a little too long. The stain had set up a bit too much, so we dampened a cloth with the stain and wiped until we got the effect we wanted. This one also came out even, and only a little bit darker than the pine. The stain/toner worked equally well on unfilled oak. The grain was raised somewhat, but the color looked good to us.

Feeling pleased with the results so far, we next wiped stain onto the filled oak samples—and disaster struck! Instead of penetrating into the wood grain, as it had with the unfilled samples, the stain just laid on the surface in a muddy puddle. We set these samples aside for further research.

After about two hours we checked our unfilled samples. With all of them, the stain was dry to the touch, so we sanded very lightly with #220 closed-coat paper and wiped them down with a tack rag.

With each of the samples we had left a clear, unstained area so we could know right away if the stain had completely dried. By brushing clear finish from the stained to the unstained area, we could see if the stain was running. It didn't, in any of the samples. The stain accepted the varnish with no streaking, so we coated three samples of each unfilled wood with gloss, semi-gloss, and satin finish. Just to see what would happen, we also brushed finish onto a piece of filled oak.

"All in all, it seems to us that the Varathane one-day finishing system offers a breakthrough for the woodworker in a hurry, or for projects where time is of the essence. Be careful about fillers, though."

In just a little less than three hours the unfilled samples were dry and ready for a second coat, which went on easily. The finish on the filled sample was still quite tacky, didn't completely dry for a couple of days, and never got as hard as it did on the unfilled samples.

After almost 3½ hours we applied a third coat, which set up hard enough to handle in about six hours. Total elapsed time for the test in our shop was about 14 hours—a little longer than Flecto claims. But if you would stick to a tight schedule you could indeed stain and apply three coats of clear finish in a single day.

FINISHING SYSTEM DELIVER?

Project Builder Jim Boelling tests Varathane wood toner/stain and clear finish in the *WOOD* Shop. Jim liked what he saw.

STEER AWAY FROM STEARATES

How did we goof with the filled samples? The villain, we learned after consulting several experts in the coatings field, was lurking in the filler. Some fillers, though not all, contain stearates—waxy fats that make it easier to sand the filler. Stearates get along fine with traditional finishes such as shellac, varnish, and lacquer, but they just aren't at all compatible with polyurethane.

The moral of our story is clear: If you want to use filler under the Varathane one-day system, choose one that doesn't contain stearates. That's not as easy as you might think, however, because the labels on many wood fillers are mum about whether the product includes stearates or not. We tried three fillers before we found one—Sherwin Williams Natural Transparent Semi Paste Filler—that would accept the Varathane. Samples filled with this product turned out just as handsome as the unfilled boards.

Unfortunately, the only way you can know for sure that a particular filler will work with the Varathane system is to conduct a test like the one we did. This adds another day to the schedule, of course, but it assures that you won't end up with a mess on your hands. Doing a few samples also gives you a chance to experiment with the effects you can achieve with the toner/stain.

THE RESULTS—MOSTLY POSITIVE

We found that both the stain and the finish were easy to use, and clean up readily with good old soap and water.

As with most emulsion stains, you don't get quite the clarity of color that oil stains give, but the Flecto Varathane version penetrates surprisingly well, and it's easier to control. The clear top coatings brushed on smoothly in our test and had fair build, especially when you consider how fast they dry.

And in all, it seems to us that Flecto's Varathane one-day finishing system offers a breakthrough for the woodworkers in a hurry. It's also a boon for projects where finishing time is of the essence.

Be careful about what kind of fillers you use with this product, though. The same caution goes for applying Flecto's clear finish over another manufacturer's stain or vice versa. Compatibility can be a problem with "new-generation" finishes including polyurethane, so always test a sample first.

Written with James A. Hufnagel
Photographs: Mike Dieter Photography; Hopkins Associates

KIDS
COMPANY

fun for all KIDS' PLAY STRUCTURE

Print this article

School will soon be out, and wouldn't it be great to turn your youngsters or grandchildren loose with this versatile play structure this summer? We guarantee they won't want to leave the backyard.

Kids can swing from the rear extension, operate the boom out front, or simply hide away in the platform clubhouse. The sturdy construction rests on four treated 4×4 posts anchored in concrete in the ground.

The play center pictured here took a team of two about three weekends to complete. Cost for materials in our town was approximately $450.

If you wish, simplify the design by eliminating the crane and swing. Presto! You have a "treeless" tree house or an Army blockhouse.

One caution, though: You'll probably get the urge to climb in and play awhile yourself. It's OK—we're all kids at heart!

Note: We designed this structure for children 5 years and older. Safety bars in the round windows and in the roof "lookout tower" help restrict access to the roof. You can't be too safe when it comes to kids! Also, we divided the Bill of Materials into three sections to keep the items with the drawing where the parts are shown. The supplies for the entire play structure appear on p. 64.

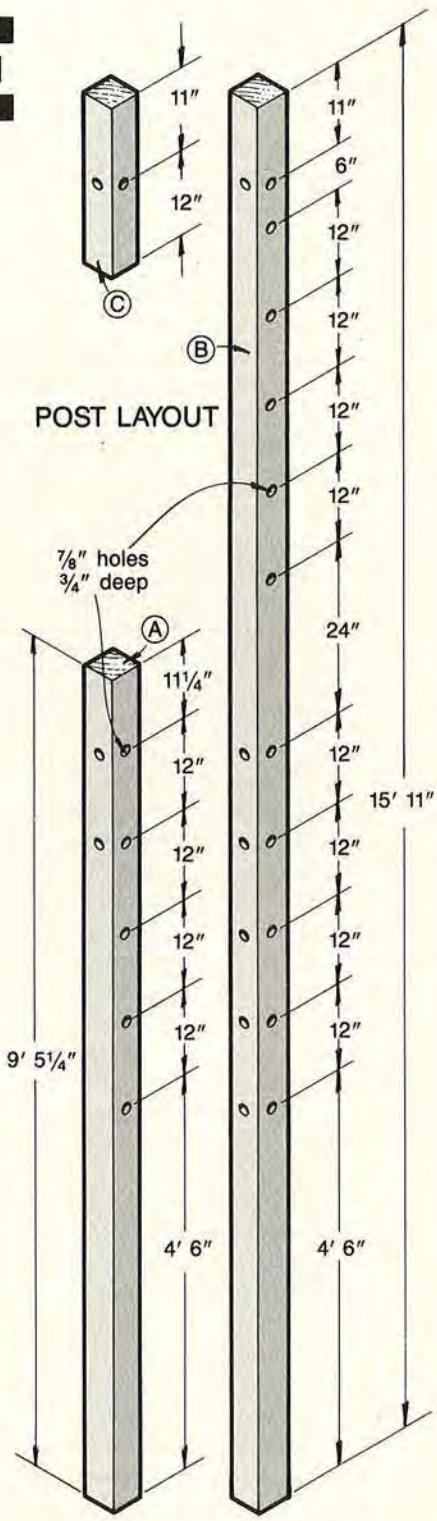
PHASE I
SETTING THE POSTS

1 From 4×4 pressure-treated stock, cut two each of parts A, B, and C to length, as indicated in the Post-Layout Drawing. Mark and bore the ⅞" holes ¾" deep in A, B, and C where shown in the drawing. (Remember that you are working in pairs of A's, B's and C's, and that the holes in one A must be a mirror image of those in the other.) Mark all the hole locations in each pair first to ensure that you drill along the correct edges of each post. Set the short 4×4s (C) aside for now; you'll use them later when building the roof. Cut the ¾" conduit rungs (D) to length with a hacksaw.

Note: We set the posts of our play structure 42" deep in concrete for stability and protection from frost heaving. You may need to set the posts even deeper in northernmost areas of the country. If you go deeper, remember to cut the posts longer initially to keep the structure at the same height above ground as shown.

2 Lay out the location of the four postholes. They should measure 20½" from center to center. Using a posthole digger, dig four 8"-diameter holes at least 42" deep.

3 Insert the conduit rungs (D) between the tall posts (B), using pipe clamps to help force the rungs into the holes. With a helper, stand the assembly up and slide it into the holes, with the tall posts positioned at the end you want the boom of the crane to point. Put



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the short posts in the holes and finish installing the rungs.

4 *Important:* Checking that the posts are plumb in both directions and that the rungs are level, brace the posts as shown in the sketch on the bottom of this page. Mix and pour concrete into the holes.

BUILDING THE SUPPORT STRUCTURE

1 Let the concrete cure for 24 hours before further work is performed on the structure. Meanwhile cut the joists (E), header joists (F), and headers (G) to length, as indicated in the Bill of Materials.

Safety Note: *Much of the assembly now takes place several feet off the ground. You need a sturdy stepladder, extension ladder, and a helper for safety's sake.*

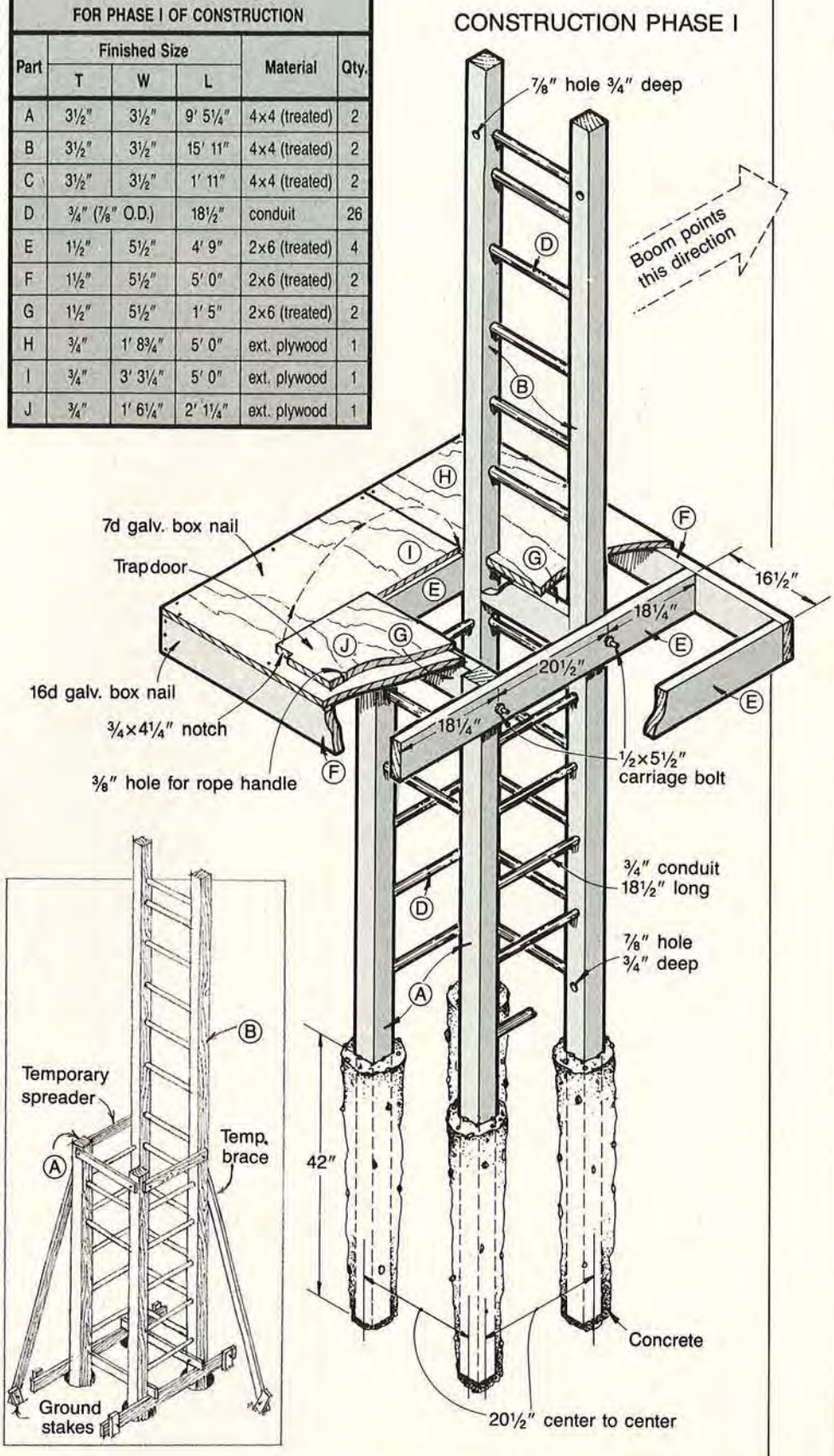
2 Level and clamp two joists (E) to the four posts where shown in the Construction Phase II Drawing. Then drill the holes and bolt both E's to the posts. Complete the platform framing by nailing in place the headers (G), the header joists (F), and finally the outside joists (E) where shown in the drawing.

3 Cut the platform-flooring panels (H, I) to size from ¾" treated exterior plywood. Nail the flooring to the joists and headers, trimming if necessary to keep the edges of the flooring panels flush with the edges of the joists and headers. Note that part H needs to be notched and that it covers only half of header G, leaving a recess for the trapdoor to close flush. When cutting the trapdoor hole in part I, line up the three cuts with the centers of the joists (E) and header (G). Making straight cuts will allow you to use the cutout in part I as the trapdoor (J). Notch the corners of the trapdoor where shown.

4 Mount the trapdoor to I with two 3" strap hinges. Drill a ⅜" hole through the door. Run a piece of rope through the hole and tie a knot on the bottom, then loop the top of the rope and secure it with a knot to form a handle for the door.

Bill of Materials
FOR PHASE I OF CONSTRUCTION

Part	Finished Size T	W	L	Material	Qty.
A	3½"	3½"	9' 5¼"	4x4 (treated)	2
B	3½"	3½"	15' 11"	4x4 (treated)	2
C	3½"	3½"	1' 11"	4x4 (treated)	2
D	¾" (⅞" O.D.)		18½"	conduit	26
E	1½"	5½"	4' 9"	2x6 (treated)	4
F	1½"	5½"	5' 0"	2x6 (treated)	2
G	1½"	5½"	1' 5"	2x6 (treated)	2
H	¾"	1' 8¾"	5' 0"	ext. plywood	1
I	¾"	3' 3¼"	5' 0"	ext. plywood	1
J	¾"	1' 6¼"	2' 1¼"	ext. plywood	1



PHASE II
ERECTING THE FRAME

1 Cut the studs (K) and top plates (L, M), side window headers (N), window safety bars (O), and boom window headers and sills (P) to length. Drill ¾" holes ¾" deep in the studs (K) for the window bars, where shown in the Side-Section Drawing. Drill holes in two K's for the safety bars to prevent access through the swing-support opening.

2 Toenail the studs (K) to the floor (you'll need to use some temporary braces until you nail the top plates in place). Install the window bars between the window studs, where shown in the side and rear openings. Nail the top plates and window headers in position, using pipe clamps to hold the headers and window bars in position. (The framework will still be a bit wobbly at this point, but not to worry—the rest of the framework and plywood will stabilize it.)

BUILDING THE BOOM

1 Cut the upper arms (Q), lower arms (R), arm ends (S), and conduit boom spreaders (T, U) to size. Miter-cut and form a 45° mitered-half lap on *one* end of each Q and R, and *both* ends of each S, where shown in the Side-Section and Construction Phase II Drawings. (We mitered the ends of our pieces with a miter saw. Then we mounted a dado blade in the radial-arm saw, set the miter angle at 45°, and cut the half-lap joints.)

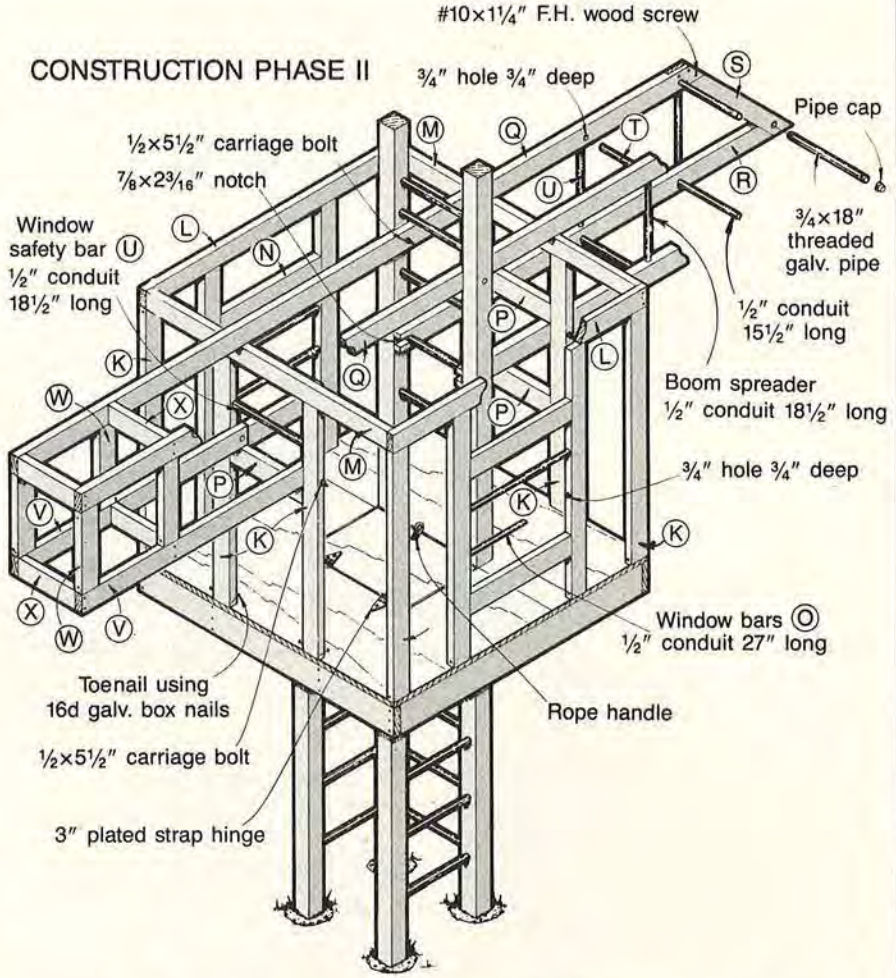
2 Lay out and drill ¾" holes ¾" deep in each Q and R. See the Side-Section Drawing for locations. These holes will accept T and U.

3 Measure 6' 1¼" from the mitered end of each upper arm (Q), and drill a hole through the center of each arm and through the two taller posts (B). Using ½×5½" carriage bolts, bolt the upper arms to the B posts. Clamp the upper arms to the top plates (M) so that the distance between the arms is constant from end to end. Then nail the arms to the top plates.

4 Notch the lower arms (R) to fit around one of the conduit rungs inside the structure. Install the boom spreaders. Assemble the mitered end of the boom using epoxy and four #10×1¼" F.H. wood screws per joint where shown in the Construction Phase II Drawing. [Be sure to allow room for the 1⅛" pipe holes that you will drill later in the end of the lower boom joints (R, S).]

5 Using an expansion bit, drill 1 1/16" holes in the ends of the lower boom joints (R, S) where shown in the Construction Phase II Drawing. Cut ¾" galvanized pipe to length, and have both ends threaded (most hardware or plumbing supply stores will thread pipe for a small charge). Install the pipe in the holes in both lower booms and attach the pipe caps. (We used epoxy on the threads to prevent the caps from unthreading.)

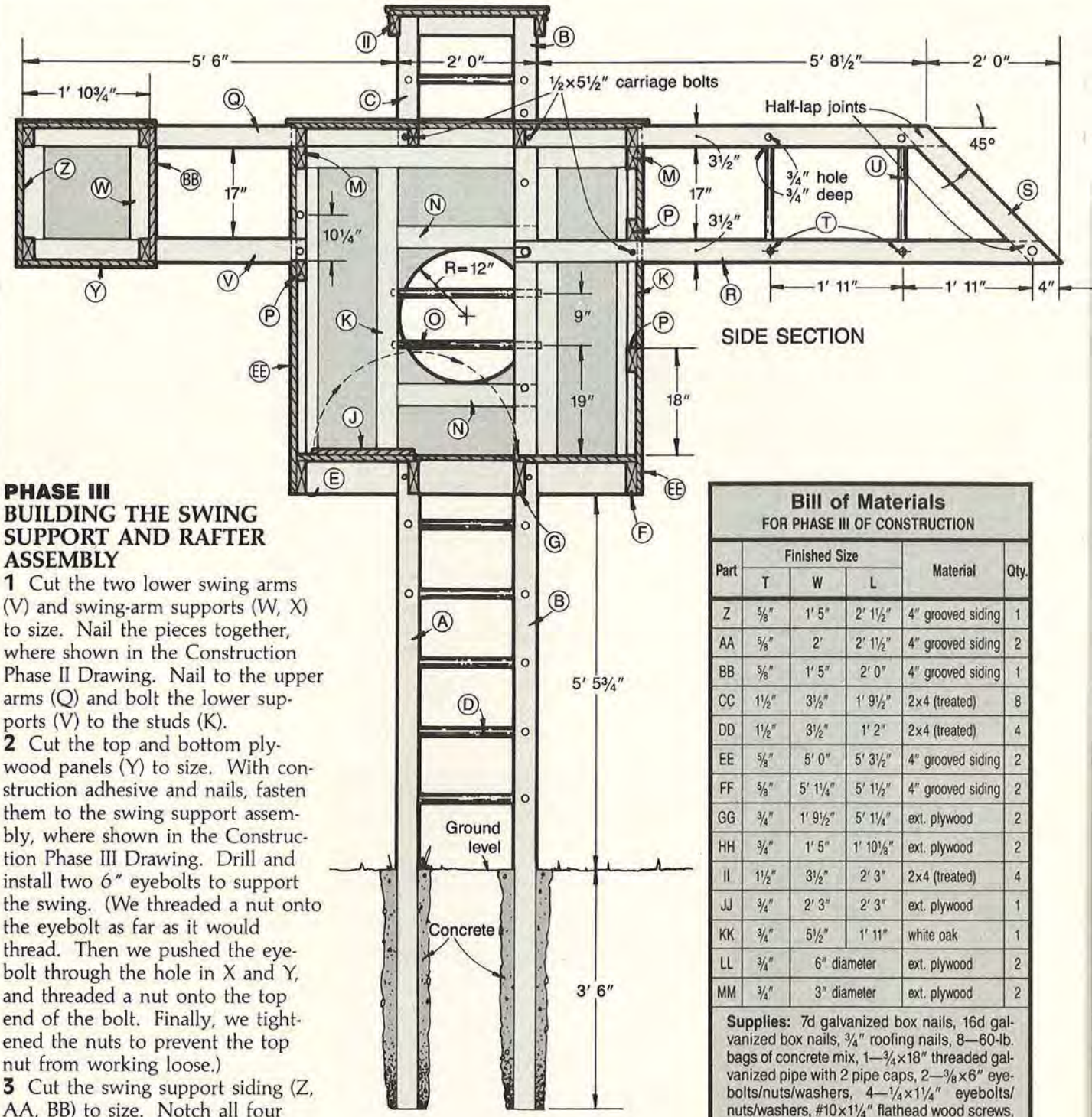
6 Bolt the lower boom arms (R) to the appropriate studs K.



Bill of Materials
FOR PHASE II OF CONSTRUCTION

Part	Finished Size T	W	L	Material	Qty.
K	1½"	3½"	4' 2¼"	2×4 (treated)	12
L	1½"	3½"	5' 0"	2×4 (treated)	2
M	1½"	3½"	4' 9"	2×4 (treated)	2
N	1½"	3½"	2' 0"	2×4 (treated)	4
O	½" diam. (⅞" O.D.)		2' 1½"	conduit	4
P	1½"	3½"	1' 5"	2×4 (treated)	3
Q	1½"	3½"	13' 6"	2×4 (treated)	2
R	1½"	3½"	8' 0"	2×4 (treated)	2
S	1½"	3½"	3' 1"	2×4 (treated)	2
T	½" diam. (¾" O.D.)		1' 3½"	conduit	4
U	½" diam. (¾" O.D.)		1' 6½"	conduit	5
V	1½"	3½"	4' 1½"	2×4 (treated)	2
W	1½"	3½"	1' 5"	2×4 (treated)	4
X	1½"	3½"	1' 2"	2×4 (treated)	4
Y	¾"	1' 5"	1' 11⅜"	ext. plywood	2

Continued



PHASE III
BUILDING THE SWING SUPPORT AND RAFTER ASSEMBLY

1 Cut the two lower swing arms (V) and swing-arm supports (W, X) to size. Nail the pieces together, where shown in the Construction Phase II Drawing. Nail to the upper arms (Q) and bolt the lower supports (V) to the studs (K).

2 Cut the top and bottom plywood panels (Y) to size. With construction adhesive and nails, fasten them to the swing support assembly, where shown in the Construction Phase III Drawing. Drill and install two 6" eyebolts to support the swing. (We threaded a nut onto the eyebolt as far as it would thread. Then we pushed the eyebolt through the hole in X and Y, and threaded a nut onto the top end of the bolt. Finally, we tightened the nuts to prevent the top nut from working loose.)

3 Cut the swing support siding (Z, AA, BB) to size. Notch all four corners of BB to fit around the boom arms (Q, V). Again using construction adhesive, glue and nail the siding pieces to the swing support framework.

4 Install the conduit for the topmost rungs in the two short 4×4s (C) that you cut and drilled earlier. Bolt both C's in position against the upper arms (Q). The top of the C's should be level with the top of the B's; trim if necessary.

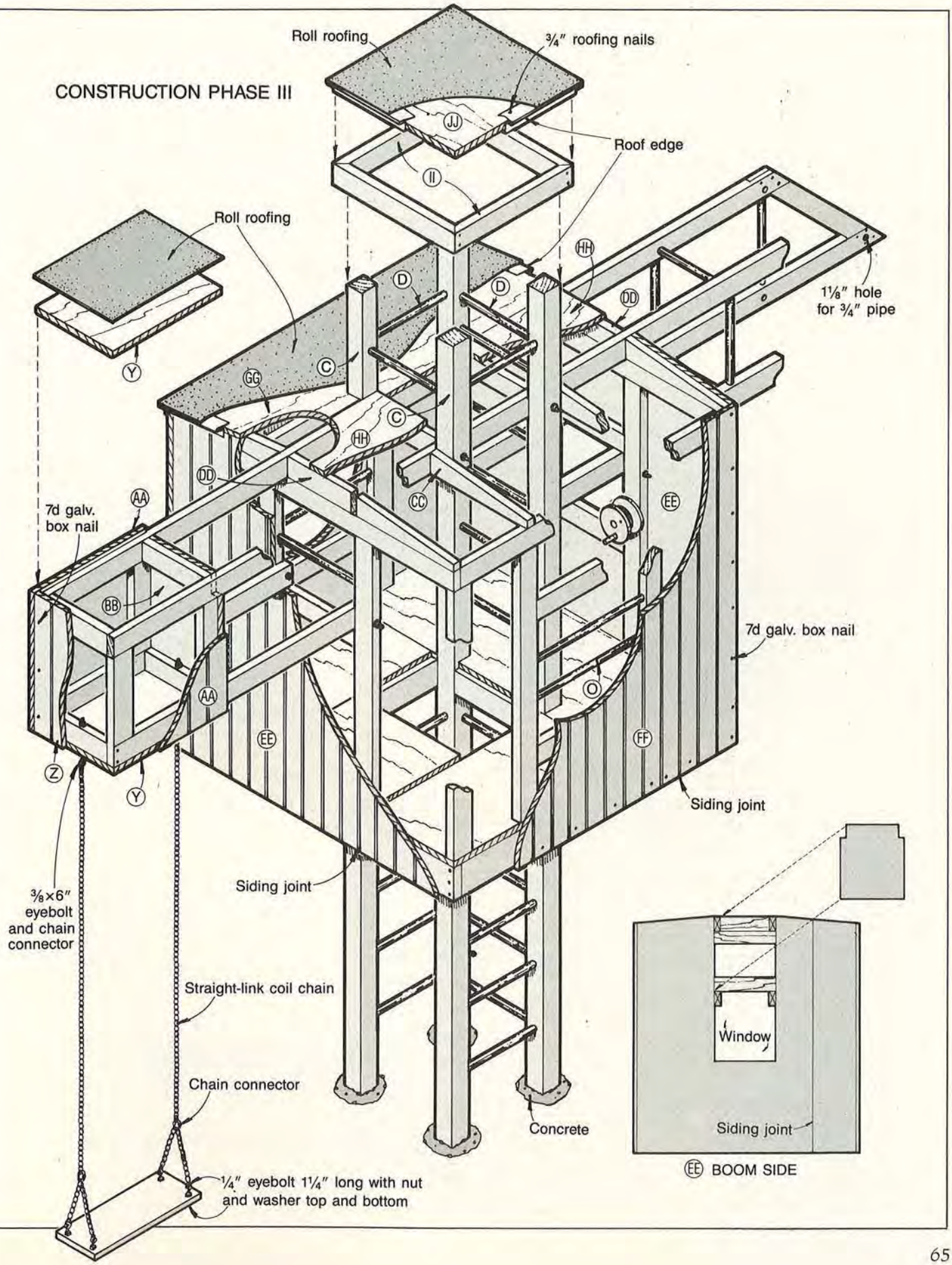
5 Cut the rafters (CC, DD) to length. Taper-cut the CC rafters, and nail them in place where shown in the Side Section and Construction Phase III Drawings.

Instructions continued on page 66

Bill of Materials
FOR PHASE III OF CONSTRUCTION

Part	Finished Size T	W	L	Material	Qty.
Z	⅝"	1' 5"	2' 1½"	4" grooved siding	1
AA	⅝"	2'	2' 1½"	4" grooved siding	2
BB	⅝"	1' 5"	2' 0"	4" grooved siding	1
CC	1½"	3½"	1' 9½"	2x4 (treated)	8
DD	1½"	3½"	1' 2"	2x4 (treated)	4
EE	⅝"	5' 0"	5' 3½"	4" grooved siding	2
FF	⅝"	5' 1¼"	5' 1½"	4" grooved siding	2
GG	¾"	1' 9½"	5' 1¼"	ext. plywood	2
HH	¾"	1' 5"	1' 10⅛"	ext. plywood	2
II	1½"	3½"	2' 3"	2x4 (treated)	4
JJ	¾"	2' 3"	2' 3"	ext. plywood	1
KK	¾"	5½"	1' 11"	white oak	1
LL	¾"	6" diameter		ext. plywood	2
MM	¾"	3" diameter		ext. plywood	2

Supplies: 7d galvanized box nails, 16d galvanized box nails, ¾" roofing nails, 8—60-lb. bags of concrete mix, 1—¾×18" threaded galvanized pipe with 2 pipe caps, 2—⅜×6" eyebolts/nuts/washers, 4—¼×1¼" eyebolts/nuts/washers, #10×1¼" flathead wood screws, 14—½×5½" carriage bolts/nuts/flat washers, ⅜×6" carriage bolts/nuts/flat washers, 50 sq. ft. of 90-lb. roll roofing, 4—10' lengths of galvanized roof edge, 2—3" plated strap hinges, ¾" dowel rod, 5—chain connectors, 25' of #2 straight link coil chain, 4—single-block pulleys for ¼" rope, 50' of ¼" braided nylon for rigging and door handle, 1—plastic utility bucket, primer, paint, exterior construction adhesive, fibrated roofing cement, silicone caulk, exterior polyurethane


CONSTRUCTION PHASE III
Roll roofing
¾" roofing nails
Roof edge
Roll roofing
1⅛" hole for ¾" pipe
7d galv. box nail
7d galv. box nail
Siding joint
Siding joint
⅜×6" eyebolt and chain connector
Straight-link coil chain
Chain connector
¼" eyebolt 1¼" long with nut and washer top and bottom
Concrete
Window
Siding joint
(EE) BOOM SIDE

APPLYING THE SIDING AND ROOFING

1 Cut the siding (EE, FF) to size, making sure that each seam will center on a stud when butting the siding edge to edge. Cut the boom openings in each EE. Mark the 12" radius openings on the back side of each FF, and cut each to shape. The top of the siding should be flush with the top edge of the rafters. Glue and nail the siding in place. *Be sure to clinch over any exposed nails on the inside.*

2 Cut the plywood pieces (GG, HH) to fit the roof. The pieces should extend to the outer edges of the siding and cover the 2×4s of the upper roof opening. Glue and nail the plywood pieces in position.

3 Miter-cut the ends of the four roof members (II) and nail them in place flush with the tops of B and C. Cut the plywood for the tower roof (JJ); then nail it in place.

4 Using tin snips, miter-cut the galvanized roof edge to length for the tower and main roof edges and nail them in place where shown.

5 Cut roll roofing for the tower, main roof, and the swing support. The roll roofing should sit flush with the edges of the galvanized roof edge. Apply a liberal coat of fibrated roofing cement to the roof edge and plywood; then nail it down. Caulk around the posts.

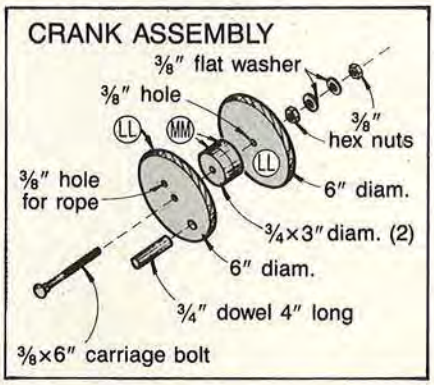
ATTACHING THE SWING

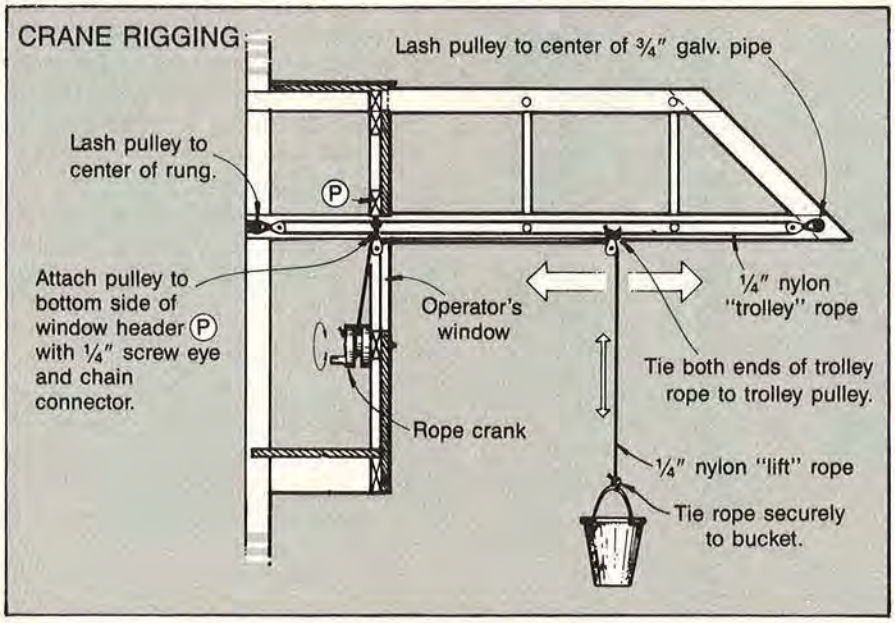
1 Using chain connectors, attach two lengths of chain to the eyebolts secured to the swing support. Cut the lengths of chain to achieve the best height for your youngsters.

2 Cut the swing seat (KK) to size. Rout a ¼" round-over on the edges. Drill ¼" holes in the seat for four eyebolts. Fasten the eyebolts to the swing seat.

3 To ensure that the swing chair will sit level, start by cutting two 16" lengths of chain. Attach the chain to the pair of eyebolts at either end of the seat by spreading the eyes, slipping the chain into the eye, and reclosing the eyes.

4 Connect the chain connector to the middle link of both short lengths of chain connected to the swing chair. Attach the swing chair assembly to the two longer chains via the chain connectors.




CRANE RIGGING
Lash pulley to center of ¾" galv. pipe
Lash pulley to center of rung.
P
Attach pulley to bottom side of window header P with ¼" screw eye and chain connector.
Operator's window
¼" nylon "trolley" rope
Tie both ends of trolley rope to trolley pulley.
Rope crank
¼" nylon "lift" rope
Tie rope securely to bucket.

INSTALLING THE CRANE-LIFT ROPE

***Note:** The crane is equipped with both a **lift rope** and a **trolley rope.** You raise the bucket by winding the lift rope on the rope crank. To move the trolley pulley from the outer end of the boom to the operator's window, you pull on the lower trolley rope. Position the trolley pulley before lifting the bucket. As a safety precaution, use the lift rope only with a bucket as shown in the Crane-Rigging Drawing.* Do not *replace the bucket with a hook or a loose rope end. This is to prevent children from accidentally getting tangled up or injured.*

Also, we originally rigged the lift and trolley ropes as shown in the opening photo. After some time, and much play, we found that the ropes were getting tangled. We revised the rigging where shown in the Crane-Rigging Drawing for a more trouble-free system.

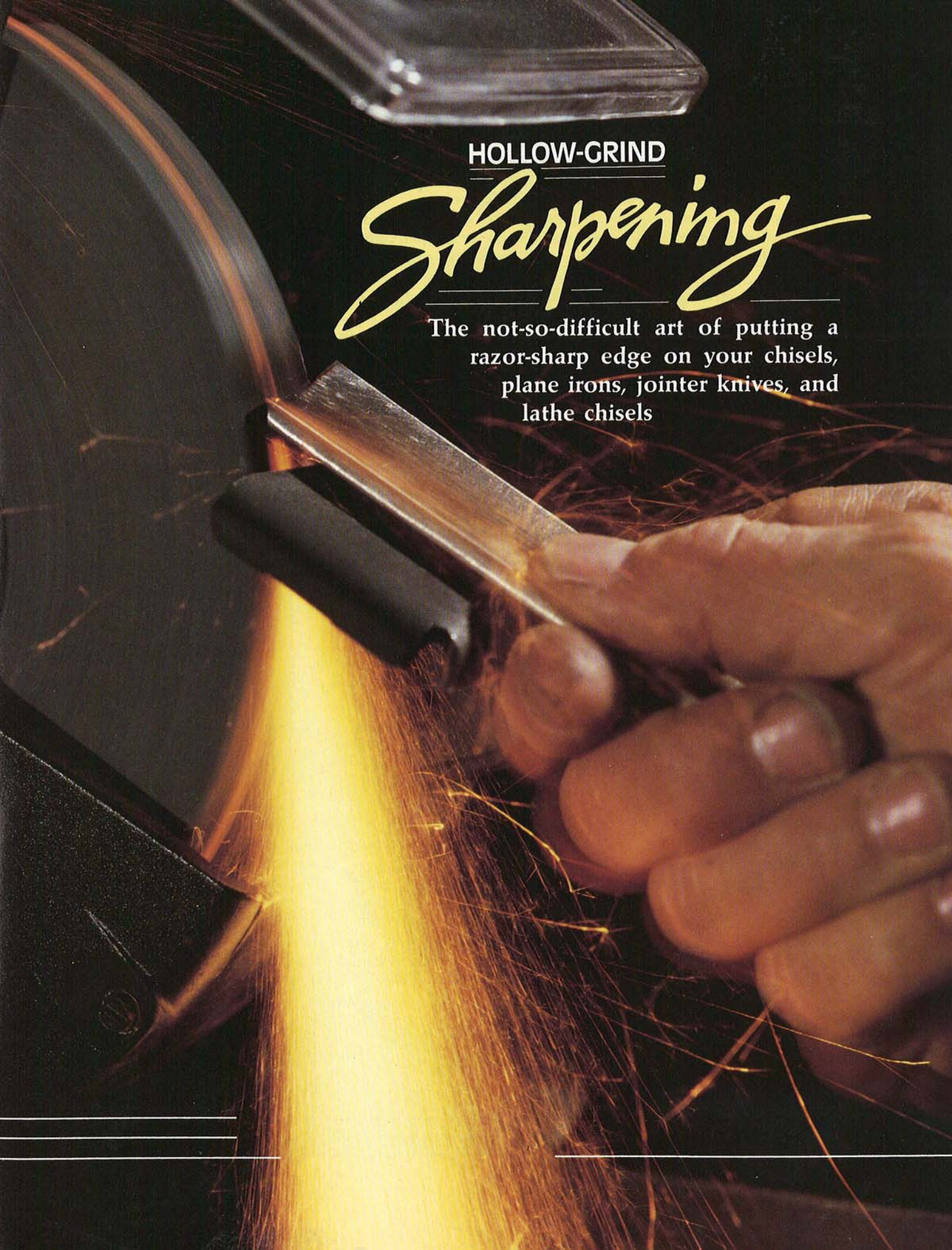
1 Cut the crank pieces (LL, MM) to size where shown in the Crank-Assembly Drawing at *left.* Construct the rope crank, gluing the parts together. Bolt the crank to the stud and siding so that it turns freely while firmly in place where shown in the Crane-Rigging Drawing.

2 Lash a pulley to the center of the pipe on the outer end of the boom where shown in the Crane-Rigging Drawing. Lash another pulley to the center of the rung that the lower boom notches around.

3 Rig up the lines and the pulleys where shown. As a safety measure, *do not* install any type of lock mechanism on the lift crank. This will ensure that the rigging always stays free-moving.

4 Prime and paint the siding and plywood as desired, being careful to paint all exposed edges to prevent damage from moisture. Apply several coats of exterior polyurethane to the swing seat.

Project Design: James R. Downing
Photographs: Hopkins Associates
Illustrations: Kim Downing; Bill Zaun



HOLLOW-GRIND Sharpening

The not-so-difficult art of putting a razor-sharp edge on your chisels, plane irons, jointer knives, and lathe chisels

HOLLOW-GRIND

Sharpening

Print this article

We put a lot of miles on our cutting tools here in the *WOOD* workshop, so we do more than an average amount of tool sharpening. You would never catch any of us saying that restoring a beat-up cutting edge to its original keen state is our idea of a good time. Still, we all agree that there's no good reason why any woodworker can't sharpen many shop tools.

You don't sharpen all tools using the same techniques because each tool category requires different strategies. (Incidentally, we never sharpen carbide-tipped cutters.) But you can renew several types of shop tools—chisels, plane irons, jointer knives, and lathe chisels—by first *hollow-grinding* the cutting edge then *honing*, or refining, the edge further with a honing guide and a stone of some sort.

We honestly don't think that sharpening the tools mentioned represents too great a challenge. But as you might expect, it helps to be aware of a few tricks of the sharpening trade. That's what this article is all about.

WHAT YOU'LL NEED TO DO THE JOB

When we gathered all the items we use to hollow-grind our tools, we were surprised by how little equipment we need. Of course, you'll need a *bench grinder* or one of the slow-speed grinders now available on the market. (We use the former.) Also mandatory is a *dressing stick* or a *dressing wheel* to true up the *grinding wheel*. If you try to hollow-grind a cutting edge with a wheel that hasn't been "dressed," the results won't please you. Speaking of wheels, we use a 60-grit (medium-fine) aluminum oxide wheel because it runs fairly cool and doesn't clog with metal shavings too rapidly.

You'll also want to round up a *try square*, an *awl*, and a *felt-tip marker* or some *machinists' ink* to mark the cutting edge for grinding.

And to ensure accuracy during the honing process, we depend on a *honing guide* to control the angle of the cutting edge against the sharpening stone. While you hear of some people who say they can steady a plane iron well enough to maintain the original bevel angle, we prefer the honing guide. You can buy this tool almost anywhere for around $10 or less.

We also use two *waterstones*—a 1,000-grit and a 6,000-grit—to hone the cutting edges of our tools. Some people insist on oilstones for honing, but we like the speed and the results we get with waterstones.

If you're sharpening any wood-turning gouges, you'll need a *slip-stone* similar to the one shown later in this article. This tool removes the burr that grinding produces on the inside surface of the gouge.

Since hollow-grind sharpening involves the use of a bench grinder in most instances, we always wear eye and face protection to prevent accidents involving sparks or flying slivers of tool steel. And to keep the steel cool during grinding, you need a quench tray nearby. A small dish full of water will suffice.

Continued

A FEW WORDS ABOUT OUR SHARPENING JIG

We discovered something important while researching this article. To grind tools successfully, you must have a support system for controlling the removal of steel from the cutting edge. True, all bench grinders have a tool rest designed for this purpose. Frankly, though, we haven't found them sturdy enough or large enough to do the job well in all cases. That's why we developed the jig shown at right.

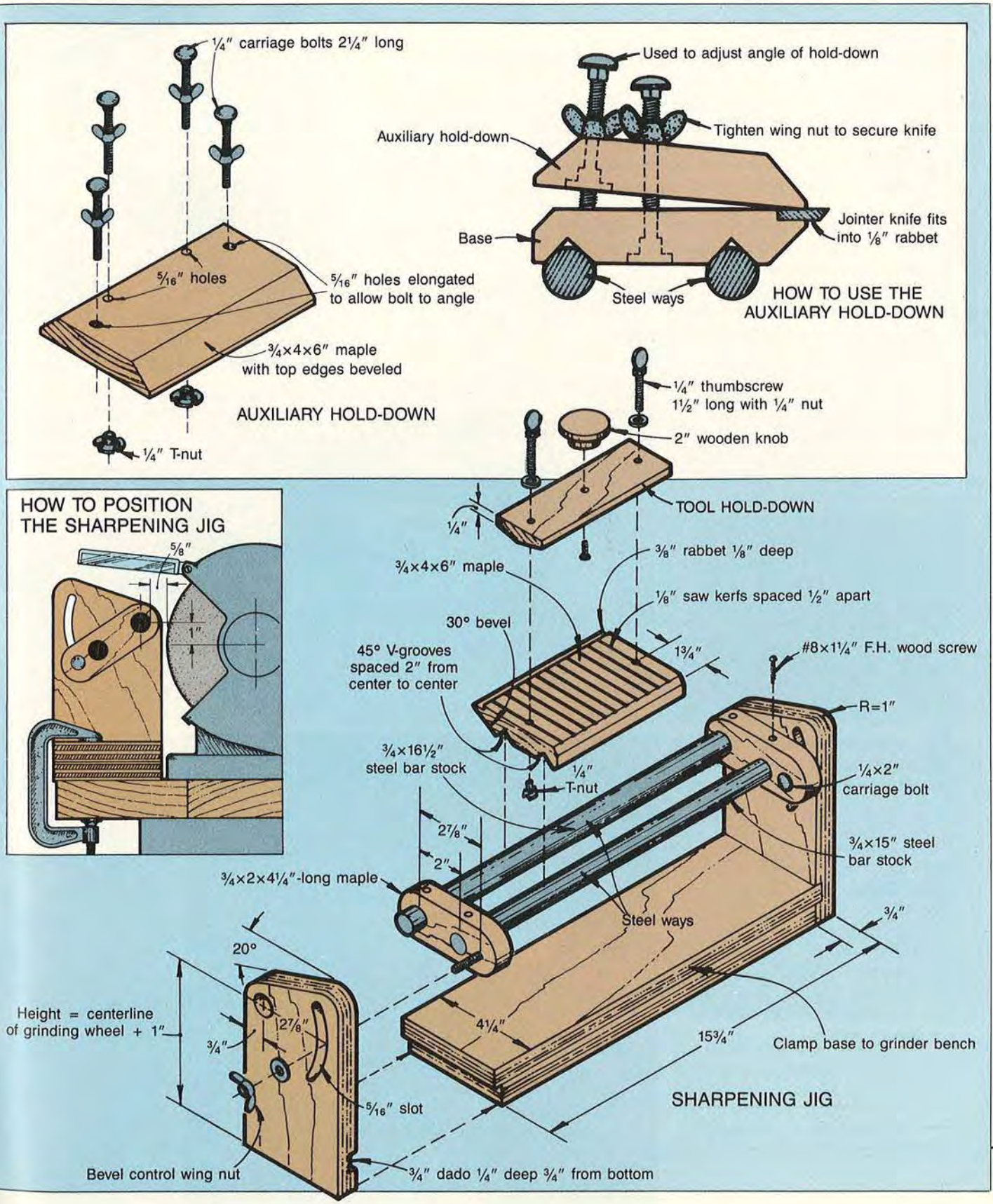
We think the sketches presented do a pretty good job of showing how to construct the jig, so we won't belabor the point. However, there are a few things you should know about this contraption.

First off, we made the jig wide enough to provide adequate support along the entire length of the cutting edge being ground. And to prevent movement, which could cause the edge to be ground unevenly, we used ¾" steel rod for the ways of the jig. For the same reason, we made it possible for you to lock the adjustable bevel guide easily at both ends.

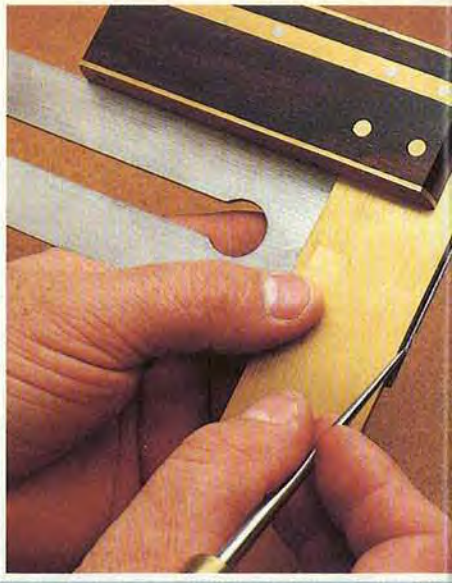
Note also the kerfs in the tool hold-down base. These make it easier for you to set the cutting edge of the tool perpendicular to the grinding wheel.

We made two interchangeable hold-downs for the base that slides along the ways of the jig. Which of these you fasten to the base depends on the tool being ground. For all tools except jointer knives, use the one shown immediately above the base in the sketch at right. With jointer knives, you'll need the auxiliary hold-down. The two sketches at the top of the opposite page show how to construct the auxiliary hold-down and how to clamp it to the base.

You can clamp the jig to a workbench in front of your grinder, if you wish, or to a wooden base that's been fastened between the grinder and the metal stand.


¼" carriage bolts 2¼" long
5/16" holes
5/16" holes elongated to allow bolt to angle
¾×4×6" maple with top edges beveled
AUXILIARY HOLD-DOWN
¼" T-nut
Used to adjust angle of hold-down
Auxiliary hold-down
Tighten wing nut to secure knife
Base
Jointer knife fits into ⅛" rabbet
Steel ways
HOW TO USE THE AUXILIARY HOLD-DOWN
¼" thumbscrew 1½" long with ¼" nut
2" wooden knob
TOOL HOLD-DOWN
¼"
⅜" rabbet ⅛" deep
¾×4×6" maple
⅛" saw kerfs spaced ½" apart
30° bevel
45° V-grooves spaced 2" from center to center
1¾"
#8×1¼" F.H. wood screw
R=1"
¾×16½" steel bar stock
¼" T-nut
¼×2" carriage bolt
2⅞"
2"
¾×15" steel bar stock
¾×2×4¼"-long maple
Steel ways
¾"
20°
Height = centerline of grinding wheel + 1"
2⅞"
¾"
4¼"
15¾"
Clamp base to grinder bench
SHARPENING JIG
5/16" slot
Bevel control wing nut
¾" dado ¼" deep ¾" from bottom
HOW TO POSITION THE SHARPENING JIG
⅝"
1"

HOLLOW GRINDING: THE ESSENTIAL FIRST STEP

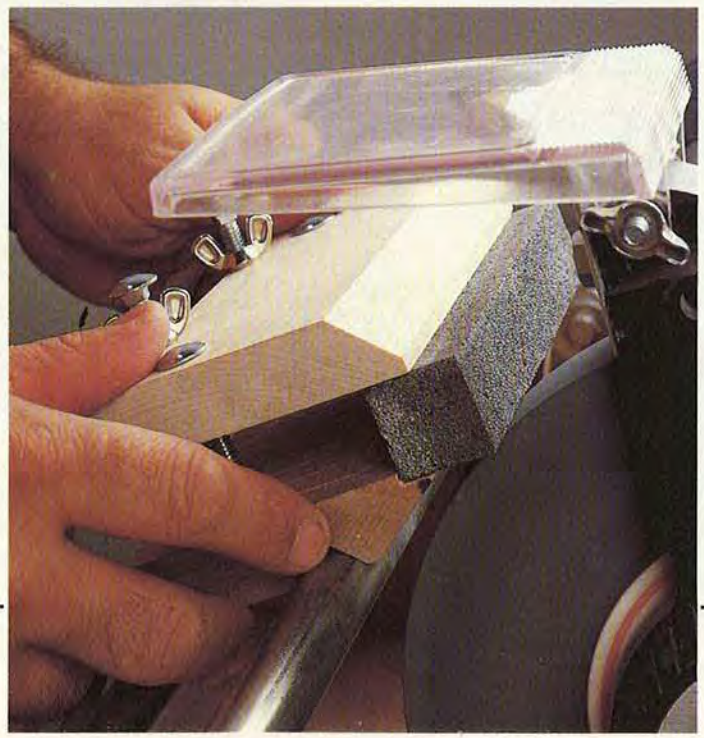


Actually, there are only two ways to sharpen tools of any kind. You can either hollow-grind and hone them, or you can flat-grind them (that's what the pros do with router bits, for example). In the case of the tools under discussion here—chisels, plane irons, jointer knives, and lathe tools—hollow grinding is the best way to go. Why? Because hollow grinding speeds the sharpening process by removing the center portion of steel between the toe (front) and heel (back) of the bevel. This translates into less time spent honing later on. The concave surface also allows a certain amount of clearance for removal of wood shavings.

The following sequence shows you how we go about grinding a square edge on a cutting tool. As we progress through the procedure, we think you'll see how important a role the jig plays.

1 Sometimes, no matter how careful you are with cutting tools, they get rusty or otherwise "gunked up." To clean and shine metal surfaces, we use a flap sander. It's fast and effective, and it makes the steel look almost like new. Tool steel is pretty hard stuff, so you don't have to worry about the flap sander ruining the tool. You needn't sand the beveled cutting edge this way, though. You'll take care of it during grinding.

2 Earlier, we mentioned the importance of your grinding wheel being squared up. To effect that, we secure our dressing stick in the hold-down as shown and move it back and forth across the wheel a few times. The dressing stick also removes the "glaze," which actually is a buildup of metal embedded in the wheel's surface. (We use a Norton 37C24-TVK dressing stick. You can purchase this type of product at most machinery supply outlets.)



3 As a cutting tool does its work, it inevitably picks up its share of nicks and cuts along the way. To remove them, first we "paint" the end of the tool with a felt-tip pen. (The pros prefer machinists' ink. One bottle of this ink will last a lifetime.) Then, we use a try square and an awl to scribe the line to which we want to grind. Remember that you want the scribe line behind all the nicks.

4 Next, capture the cutter in the tool hold-down, lower the hold-down onto the steel ways, and adjust the bevel guide so the wheel will grind off the unwanted metal at about a 90° angle to the cutting edge. Carefully position the cutter so that the wheel will only remove the desired amount of metal. Then, exert a little downward pressure on the hold-down, and move the cutter back and forth across the wheel. Don't hurry! (The sketch on page 69 shows how to construct the auxiliary hold-down and how to secure jointer knives for grinding.)

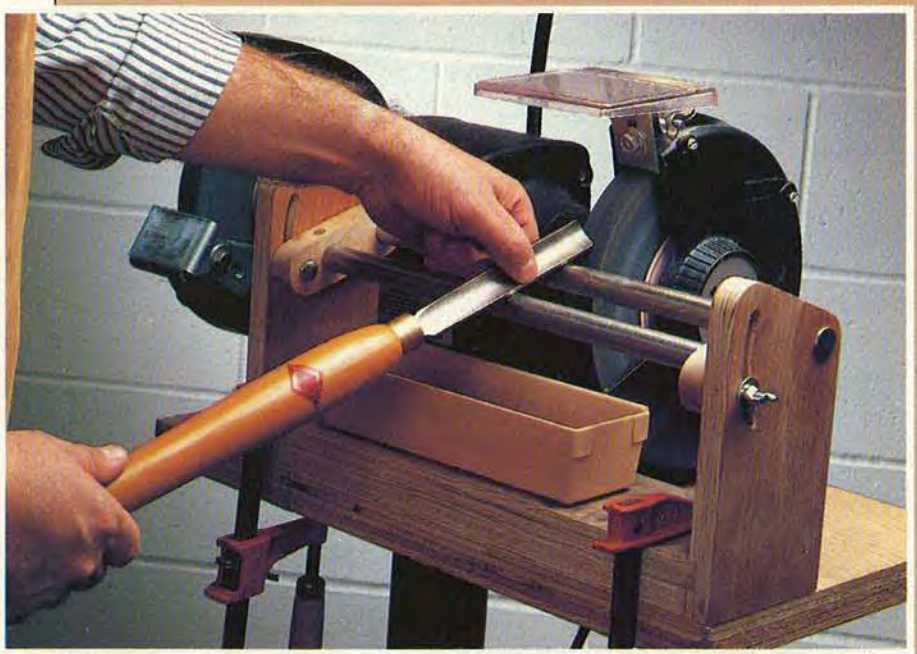
5 Once you've squared up the edge, loosen the tool hold-down thumbscrews and the wing nuts that control the bevel guide angle and adjust the bevel guide to the correct grinding angle. Take a look at your setup from the side to make sure that the angle of grind is correct. Keep in mind that you want to retain the original bevel angle of the cutter. Remember also that the bevel angle on every tool has been designed (and set at the factory) for maximum cutting efficiency. Changing the angle appreciably will result in a less-than-desired cutting action.

6 When you're sure the bevel is set correctly, slide the tool's cutting edge forward until it makes contact with the grinding wheel. Tighten the hold-down thumbscrews, turn on the grinder, and move the tool across the wheel. You may have to slide the cutting edge forward again to remove the desired amount of steel. (The object is to completely remove the squared-off edge.) Dip the tool in your quench tray frequently to keep the metal from losing temper. If you don't, the cutter will lose its edge quickly during use.

7 One good way to tell that the edge is ready for honing is to hold the tool as shown here and lightly pass it over your fingernail. If it grabs easily and shaves the nail, you're there.

Continued

8 When hollow-grinding turning gouges, we use a different procedure. We position the bevel guide at the angle that matches that of the gouge, move the gouge forward until the metal meets the wheel, and roll the gouge from the center toward each side. Notice that we steady the gouge with one hand and roll the tool with the other. This procedure takes a certain amount of getting used to. Here again, remove only a little steel at a time, and be sure to quench the steel at frequent intervals.



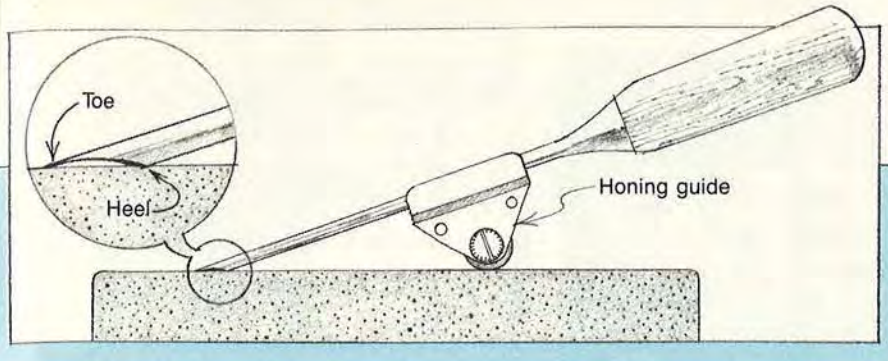
9 The grinding process creates a burr along the inside of the cutting edge. You will want to remove this to ensure the sharpest possible cutting edge. A couple of passes with a slipstone, as shown, will remove the unwanted burr.

HONING: HOW TO PUT A RAZOR-SHARP EDGE ON YOUR HOLLOW-GROUND TOOLS

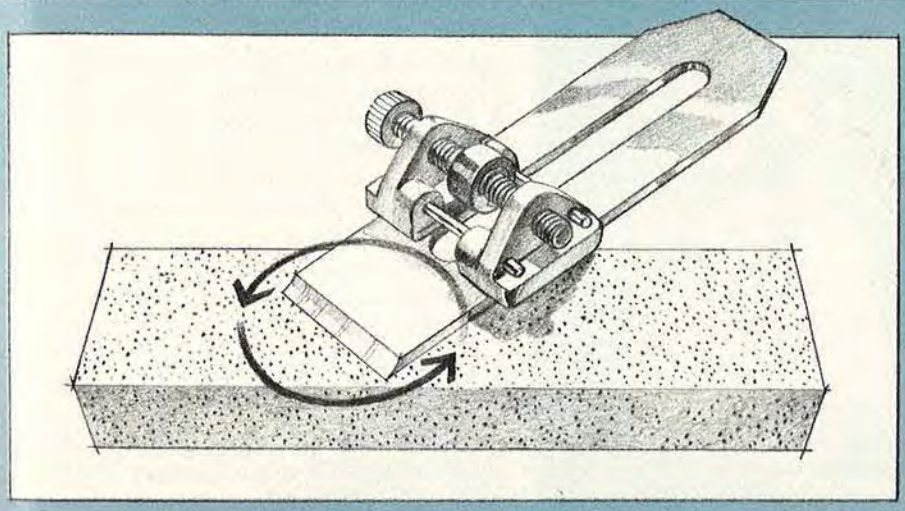
It would be great if all you had to do to renew a tired cutting edge was hollow-grind it. Unfortunately, there's more to the story than that. Honing picks up where hollow-grinding leaves off. It transforms a "pretty sharp" edge into a "razor-sharp wood-shearing machine."

Actually, honing is a several-step process in which you alternately sharpen the front and back surfaces of the cutting edge. The photos, drawings, and captions that follow show how we hone hollow-ground tools.

1 As mentioned earlier, we use waterstones to hone our tools. Because waterstones wear away quickly when used, you need to make sure that the surface of the stone is flat before you use it. We lay a sheet of wet/dry abrasive on a piece of plate glass, sprinkle water on the abrasive, and then slide our premoistened stone over the abrasive several times. We use plate glass because of its reputation for being flat.



2 To make sure the stone doesn't move around, we capture it in a simple jig. When honing wood chisels and plane irons, we enlist the help of a honing guide. For one of these tools to perform correctly, you need to make sure that you position the tool being sharpened in it so that both the toe and heel of the cutting edge rest on the stone (see the drawing above for how it should look). Move the cutting edge back and forth along the stone several times. (If you're honing a jointer knife or a lathe chisel, you'll have to maintain the angle free-hand.)

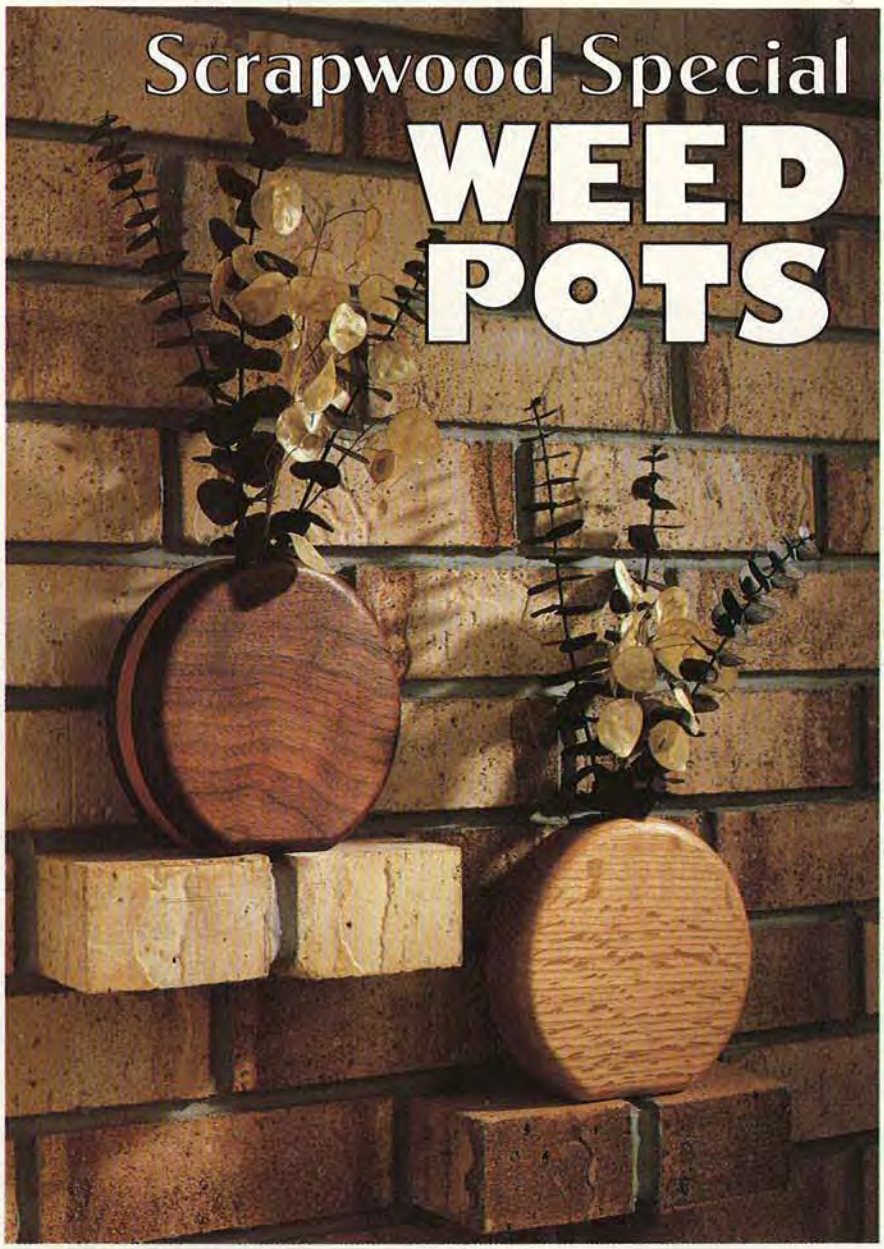


3 Every time you hone one surface of the cutting edge, you create a burr on the opposite surface. To remove the burr, hold the blade with the flat side down and make a few circular passes over the stone as shown in the sketch. Since you will need to hone both the beveled cutting edge and the flat back side of the blade several times, make sure you keep the honing guide secured to the blade during the entire process. Otherwise, you'll spend lots of time trying to adjust the honing guide angle.

Note: When we're sharpening jointer knives or lathe chisels, we don't feel that it is necessary to hone the cutting edge with a stone finer than the 1,000-grit waterstone. Why? Because both of these types of tools do their cutting with the help of a power tool, which means that the edge needn't be as sharp as if the tool is hand-powered. But with wood chisels and plane irons, we repeat steps 1, 2, and 3 with a 6,000-grit waterstone. Going the extra distance will pay big dividends, especially when you call on your tool to cut through tough hardwoods.

Produced with James R. Downing
Written by Larry Clayton
Photographs: Hopkins Associates
Illustrations: Bill Zaun

Scrapwood Special WEED POTS



It never fails! You cut a board to length and end up with a tail-end piece that's just a hair too short for anything but the scrap box. Here's an excellent idea using those shop leftovers: decorative weed pots.

1 For the laminated pot shown at the left in the photo, cut one piece of ½" oak and two pieces of ¾" walnut scrapwood to roughly 7" square. Laminate the oak between the walnut, sandwich fashion, keeping the bottom edges as flush as possible. For the solid-oak weed pot, use a single piece of 1½"-thick scrap or laminate two ¾" pieces. (Feel free to experiment with other woods.)

2 Using a compass, mark a 6"-diameter circle, leaving a flat bottom approximately 2½" long, as shown in the Front-View Drawing.

3 Use a band saw or jigsaw to cut the pot to shape. Remove the saw marks from the edges of the pot by rotating it on a belt sander clamped to your workbench top. Hold the pot perpendicular while you sand the edges, especially when sanding the bottom, so that the pot will rest square later.

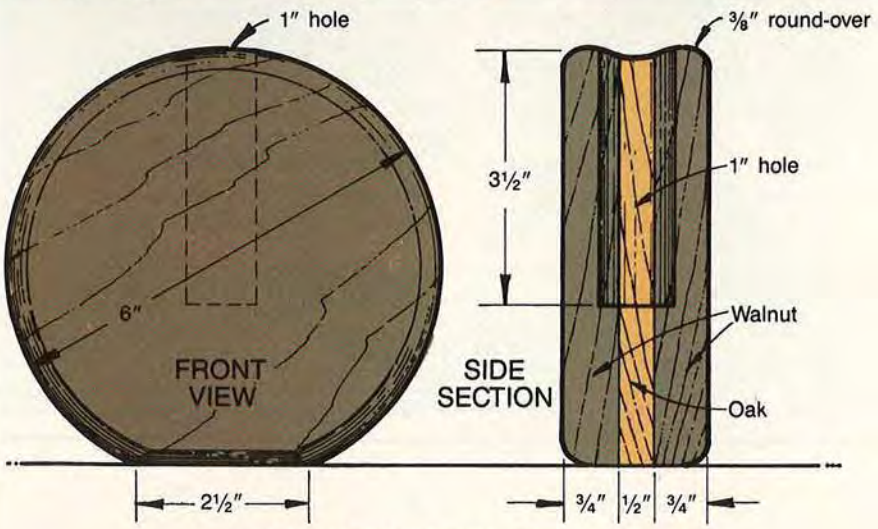
4 Locate the center of the base on one side of the pot. Then, use a square to mark the corresponding point on the top of the pot for the stem hole you will drill later.

5 Use a router with a ⅜" round-over bit to rout the edges.

6 With a 1" flat-bottomed bit, bore a 3½"-deep stem hole into the top of the pot. (If you want to use the pot for fresh-cut flowers, waterproof the hole with epoxy: Pour an ounce or two of epoxy into the hole and rotate the pot to spread an even coat inside the hole.)

6 Finish-sand the outside of the pot with progressively finer sandpaper, starting with 100 grit and finishing with 220 grit. The exposed end grain will require additional sanding.

7 Finish the weed pot with tung oil or polyurethane, including the stem hole (if you didn't coat it with epoxy earlier).



LAMINATED WEED POT

Project Design: Rob Bolson
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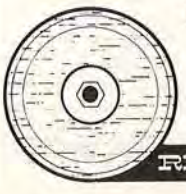

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DOMINOES

Instructions on page 45

DOMINO-NUMBERING SEQUENCE CHART

(Place pips in these combinations.)

BLANK-BLANK	TWO-THREE
BLANK-ONE	TWO-FOUR
BLANK-TWO	TWO-FIVE
BLANK-THREE	TWO-SIX
BLANK-FOUR	THREE-THREE
BLANK-FIVE	THREE-FOUR
BLANK-SIX	THREE-FIVE
ONE-ONE	THREE-SIX
ONE-TWO	FOUR-FOUR
ONE-THREE	FOUR-FIVE
ONE-FOUR	FOUR-SIX
ONE-FIVE	FIVE-FIVE
ONE-SIX	FIVE-SIX
TWO-TWO	SIX-SIX

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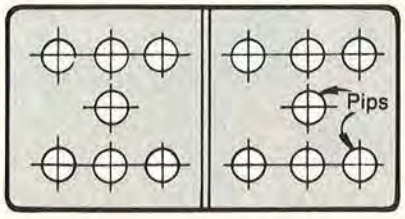
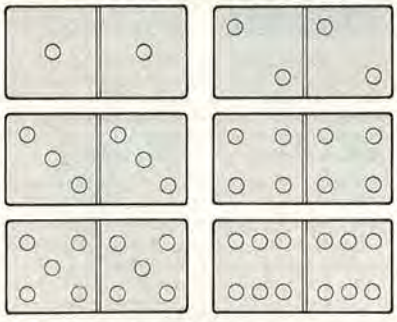


Use the full-sized domino, *above,* to position the pips for all the dominos needed for this set. The Domino-Numbering Sequence Chart, *top,* gives you the correct number of pips for each individual domino.

PIP CONFIGURATIONS



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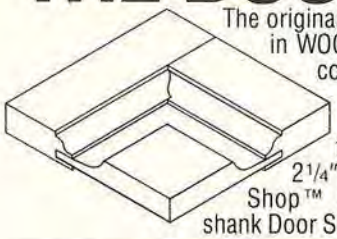

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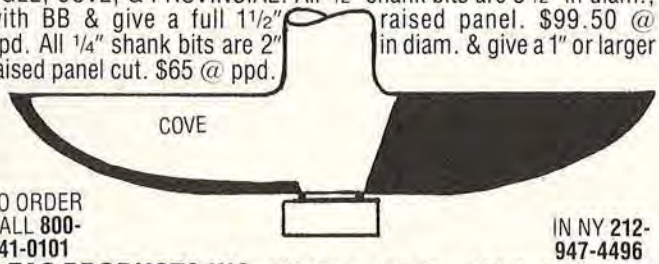

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WOOD

Father's Day Gift List

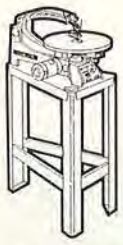
Father's Day is June 15. Check the items you want, tear out this section and casually leave it where your family can find it. They'll get the hint!

☐ A new tool is now available to make or repair any length band saw blade in minutes! Our splicer enables craftsmen to make up any length blade from economical coil blade stock quickly and easily. It comes in three models complete with detailed instructions and supplies for approximately 100 splices. NEW MILFORD SPECIALTIES CO., Dept. BHG, 24A South Main St., New Milford, CT 06776, 203-426-4276.

☐ Safety glasses that work make a great gift! These glasses offer all-side protection with a unique ratchet hinge. The special large lenses are fog-free, scratch-resistant, anti-static with an ultra-violet inhibitor. These comfortable unifit glasses meet and exceed the national safety standards. Only $9.95 delivered. KENCO SAFETY PRODUCTS, Drawer 385, Woodstock, NY 12498. Or call 800-341-4103; in NY state call 914-679-5246.

☐ The Hegner Hobbymax, from Hegner's family of precision scroll saws, is ideal for the miniaturist, hobbyist, or model-maker. Smooth, square cuts without sanding, no vibration and rarely a broken blade are what make Hegner saws a joy to use and own. A special gift for a special someone, and it's under $400. Free information. AMI, P.O. Box 312, New Castle, DE 19720.

☐ Edlco is offering a bundle for Father's Day: 10 board feet of ⅜" shorts, 3" and wider, 18"-36" long in cherry, oak or walnut. Bargain priced bundle includes a "How To" project book *and* top-grade lumber catalog! Only $39.95 delivered. Offer good through June 15th only. Specify species and send check or money order to EDUCATIONAL LUMBER COMPANY, Box 5373 W, Asheville, NC 28813.



☐ New Delta 18" electronic variable speed scroll saw offers simplified, intricate cutting to 1/64" diameter. Capacity to 2" thick, variable speed from 40 to 2000 CS/M. Electronic controller maintains constant blade speed and torque. Pivoting blade chucks permit extra fast blade changing and tensioning. 18" cast iron table tilts 30° L, 45° R, 15° up, 30° down. Dry drive for long life; ball and roller bearing construction. $950. MC/Visa accepted. HARDWOODS OF MEMPHIS, 1-800-321-5239.

☐ Professional artwork and five-color silk screening detail this woodworking logo available in Hanes 100% cotton T-shirt and cap. Logo is for the amateur and professional alike. T-shirts $10.95, S, M, L, XL, white, lt. blue or beige. Caps $7.95, adj. size, white, green, blue, maroon. Shipping and handling $1.50. MC/Visa. Call 1-800-826-1066. See ad elsewhere in this issue. WOODWORKING DESIGNS, P.O. Box 825, Ruston, LA 71270.

☐ This cordless driver drill is one of the most versatile tools ever introduced. The BD-1020R is both a drill and a screwdriver. It's 2-speed (300 and 600 rpm) and reversible, battery operated and loaded with features. Three clutch settings plus straight drive, trigger switch, easy-grip handle and a chuck key and #2 Phillip bit. Battery pack slips into the handle; one-hour quick charger. RYOBI AMERICA CORPORATION, 1158 Tower Ln., Bensenville, IL 60106, 312-766-1621.

☐ BMS-601 18" bandsaw with 12" throat, 1PH 2HP, 220V, 1725 RPM, bld. 800 RPM, bld. max width 1¼", min. bld. width ¼". Comes complete with miter gauge and fence and rails. Weight 400 lbs., height 74". Open stand. $699 delivered anywhere in continental USA. BRATTON MACHINERY AND SUPPLY, 1015 Commercial St., Tallahassee, FL 32316. Call toll-free 1-800-874-8160; in Florida call 1-800-342-2641 or 904-222-4842.

WOOD

Father's Day Gift List

☐ This up-to-date version of an old favorite, the pie safe, stands finished at 54"h × 32"w and 12"d. It can easily be reproduced using our simple kit containing plans, full instructions, tin, special patterns sized to the tin and tools to complete the metal panels. Order kit K2B only $30.75 ppd. NJ res. add tax. Get started in a new hobby —pierced tin! COUNTRY ACCENTS, Rd #2, Box 293, Stockton, NJ 08559.

☐ The new Delta 16" motorized band saw features an innovative, three-wheel design, assuring greater capacity in a compact machine. The band saw provides the versatility needed for large-scale projects and intricate curve cutting. It cuts wood, aluminum, plastic and sheet metal. DELTA INTERNATIONAL MACHINERY CORP., 246 Alpha Dr., Pittsburgh, PA 15238, 412-963-2425.

☐ Ring Master cuts concentric rings from flat wood, up to 12" in diameter. These rings can be cut at any angle or straight and will stack to *create any hollow cylindrical shape.* After the project is glued, it is returned to the Ring Master for final sanding and finishing. The newly patented machine, which is absolutely safe, can create an infinite variety of hollow shapes. RING MASTER, INC., P.O. Box 8527-A, Orlando, FL 32856, 305-859-2664.

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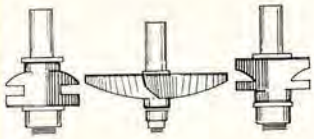
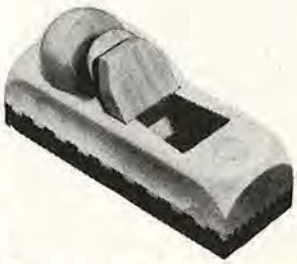
☐ The new Woodworkers Buyers's Guide to Power Tools contains thousands of photographs, facts, charts, and product descriptions of all types of woodworking equipment. Includes information on all types of stationary and hand-held power equipment, plus miscellaneous and specialty equipment. Expert advice on selecting tools and a special section on electrical motors. Check or money order for $12.95 plus $1.50 for postage to: JM PUBLICATIONS, Dept. W-HG, Box 1408, Hendersonville, TN 37077-1408.



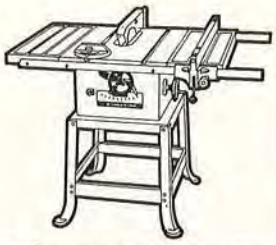
☐ Excellent quality carbide-tipped ½" and ¼" shank router bits are offered at reasonable prices. Featured are carbide-tipped 6-pc. cabinet sets for $149.95, shaper cutters from $20 and a 3-pc. panel raising set for ½" routers at $149.95. For more information call 206-236-0272 seven days a week between 10 am and 7 pm. CASCADE PRECISION TOOL CO., Box 848, Mercer Island, WA 98040.

☐ Simply cut sandpaper from standard sheets for this sleeveless drum sander. 2" × 3" $15.50 + $2.50 s/h. Many other sizes available. Money back guarantee. Send check to SINGLEY SPECIALTY CO. INC., PO Box 5087B, Greensboro, NC 27403.

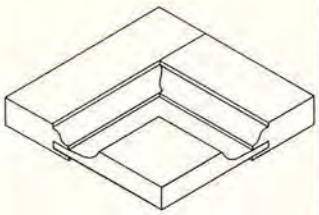


☐ 6" Wedged Block Plane has 1½" blade—ideal for general trimming and end grain planing. Beech stock, lignum vitae sole. A rare bargain at $9.95 from FINE TOOL SHOPS, Dept. WME, Box 1262, Danbury, CT 06810.

☐ The Ripstrate has revolutionized ripping on table and radial arm saws by keeping hands away from the blade. Holds work firmly against the fence and prevents kickbacks. Self adjusting. Over 10,000 in use by amateurs, professionals, schools, government and military installations. $66. Check, Visa, M/C. Call toll free 1-800-421-0256. Free brochure. FISHER HILL PRODUCTS, 4A Fisher Hill, Fitzwilliam, NH 03447



☐ Any woodworker would love a 10" table saw from Delta. Order one today in time for Father's Day. Shipped prepaid 48 states. $579 including factory rebate. Call toll-free 1-800-358-3096 and ask for Mike. ACME ELECTRIC TOOL CRIB OF THE NORTH.



☐ The original Ogee Door Shop™ as featured in Wood Magazine May/June 85, is complete with style and rail, slot and panel raising bits for the ¼" chuck router. Bits are carbide tipped and BB and will make ¾"-2¼" thick raised panel doors, $89.50 ppd. ZAC PRODUCTS INC., 533 West 34th St., NY, NY 10001. Call 800-441-0101.

☐ Nautical clock makes a great gift for dad. Polished brass anchor holds a beautiful bezel dial imported from Germany and a super-accurate quartz movement. Size is 11 × 12⅞". Suitable for boat, den, library, office or home, $42.50 postpaid. NY residents add tax. ARMOR PRODUCTS, P.O. Box 445, East Northport, NY 11731.

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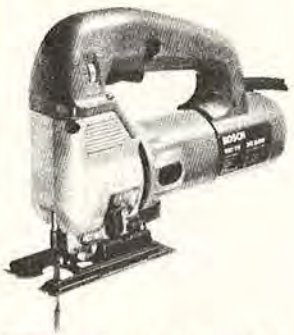
☐ Start enjoying woodcarving and whittling. The kit includes a complete set of 6 carving tools, a whittling knife, book by Bütz and two blocks of basswood. All for $39 ppd. MANNY'S WOODWORKER'S PLACE, 602 S. Broadway, Lexington, KY 40508. Toll free 1-800-243-0713. (In KY call 606-255-5444.)

☐ Moisture-related problems such as shrinking, warping, cracking can ruin the best pieces ever built. Avoid wood moisture problems by checking the wood with a moisture meter. The pocket-size Mini-Ligno moisture meter is for the serious hobbyist and professional woodworker. For more information contact: LIGNOMAT, P.O. Box 30145, Portland, OR 97230, 800-227-2105, 503-257-8957.



☐ Give a tool to be proud of ... Bosch Jig Saw for all types of construction. The Bosch 1581VS has adjustable orbital action for straight metal, ceramic or glass cutting or full orbital action for fast cutting of softer materials. Only $135. AVIATION INDUSTRIAL SUPPLY, 3900 Ulster Street, Denver, CO 80207.

☐ Vari-Stroke 2015 scroll saw's unique design enables this new saw to produce 2 cuts per stroke with virtually vibration-free operation. The Vari-Stroke has a 20" deep throat plus a large table that tilts 45° left and right. Regularly $1,199, now $899! Visa and MasterCard accepted. To order write or call: STRONG TOOL DESIGN, 20425 Beatrice, Livonia, MI 48152, 313-476-3317.

☐ Handy as a pocket on a shirt! Sturdy, ball-bearing roller, 14" × 2" diameter, swivels 360°; telescoping steel stand adjusts 21½" to 48". Model 314 Extension Roller.... $35 ppd. from WOODMASTER TOOLS, INC., 2908 Oak, Kansas City, MO 64108.

WOOD

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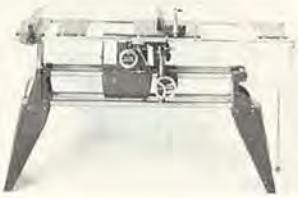

☐ No project is too large for the capabilities of the new Shopsmith Mark V Pro... and you. Designed for the woodworker who needs the capacity of a large table saw, the Mark V Pro features sawing, sanding, drilling, boring and turning. For more information write to: SHOPSMITH, INC., Dept. 9996, 6640 Poe Ave., Dayton, OH 45414-2591.

☐ Square recessed screw kit gives virtually strip proof service. Includes traymate, driver and 100 each of eight popular sizes ⅝" to 1½". Zinc plated $19.95. Brass Plated $21.95. THE WOODWORKERS' STORE, 21801 Industrial Blvd., Rogers, MN 55374. Offer expires June 30, 1986.

☐ Now you can layout precise letters and numbers for your wood craft projects. Scrollsawers and sign carvers use these specially designed lettering layout guide sets. Quick and easy-to-use—simply trace around the letters—guides are very durable. Several styles and different sizes are available. Descriptive brochure with prices, $3 (refunded with first order). SEYCO SALES, 2107 S. Garland Ave., P.O. Box 472749, Garland, TX 75047.

☐ 15-piece Freud carbide router bit set and 1HP router from Ryobi make an excellent Father's Day gift. Total list value for the pair is $462. Now available from participating Freud dealers on sale at $249. Call 800-334-4107 for your local distributor.

☐ Personalize your wood items quickly and easily with this brass branding iron. First line: HAND CRAFTED BY; second line: your choice up to 20 characters including spaces. Compact size. $29. ppd. Order by phone or mail from NOVA TOOL CO., P.O. Box 29341, Lincoln, NE 68529, 402-464-0511.

☐ You can't get more value in a table saw than this. You get Delta's new 10" contractor's saw, an adjustable dado head and a dado table insert all for just $699. And on top of that, you get $100 back directly from Delta. Your cost is $599, including delivery to your door anywhere in the 48 states. Call toll-free 1-800-645-9292. WOODWORKER'S SUPPLY OF NEW MEXICO, 5604 Alameda NE, Albuquerque, NM 87113.

☐ Carving tool kit: Give dad a quality American-made Warren Tool Kit #KBL3-W. Includes a walnut and brass interchangeable handle and three high carbon steel blades honed ready for use. Send $20.40 ppd. for the kit or 60¢ for a complete catalog and let dad choose one of over 500 items offered with a money-back guarantee. WARREN TOOL CO., INC., Rt. 1, Box 14-A, Rhinebeck, NY 12572, UPS/COD call 914-876-7817.

☐ A new clamp for woodworkers! The "Merle" lamp forces your project into square. Fully adjustable from 2⅝" × 2⅝" to 36" × 36". Excellent for clamping picture frames, cabinets or anything which requires 90° corner clamping. Industrial quality tool made of cast aluminum and steel. $18.95. MC/Visa MLCS LTD., P.O. Box 53D, Rydal, 19046. Call toll-free 1-800-523-2445, ext. 56. (In PA. 1-800-346-7511, ext. 56.)

☐ Cut the most intricate patterns in wood, plastics, light metals, etc. Just add your own ¼ hp electric motor to an Excalibur II, and start cutting! $495 US. Includes 72 blades, wrenches, and manual. Try it for 30 days. You must be satisfied, or purchase price refunded. In the U.S., call toll-free 1-800-387-9789, in Canada call collect 416-293-8624. J. PHILIP HUMFREY INTERNATIONAL, 3241 Kennedy Road, Unit 7, Scarborough, Ontario, M1V 2J9.

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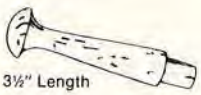

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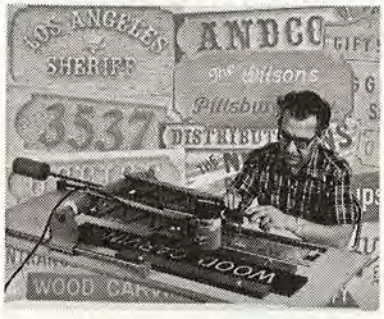

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MY "TOP 20" TOOLS FOR ACCURATE MEASURING AND LAYOUT

Sure, I've laid out and measured projects with hardly more than a tape, a folding rule, and pencil. But I learned some time ago that the saying "a craftsman is only as good as his tools" applies to me.

Take a look below and you'll see my measuring, marking, and layout tools in the photograph. It's taken me years to accumulate them, and there's not one I don't use. Here's how they earn their keep.

My 6" *folding rule* (**1**) with its 6" sliding extension measures up against an edge. Then, I have a 12' *steel tape* (**2**), probably much like yours. The 4" *combination square* (**3**) works better than a try square for aligning saw blades, and it fits my pocket. The 12" *combination square* (**4**) works the same, but takes on larger chores.

I can reproduce any angle with my 10" *sliding T-bevel* (**5**). Above it, you'll see the 18" *flexible straight-edge* (**6**) I borrowed from the drafting table for the shop. It even copies an irregular surface. My inside/outside *linear-scale caliper* (**7**) tells true stock thicknesses and inside measurements.

Simple instruments like the *compass* (**8**) make accurate circles or step off layout lines. *French curves* (**9**) create fluid, curved lines between points. The *trammel beam* (**10**) and its *points* (**11**) on their storage stick work as a compass does, but on a bigger scale.

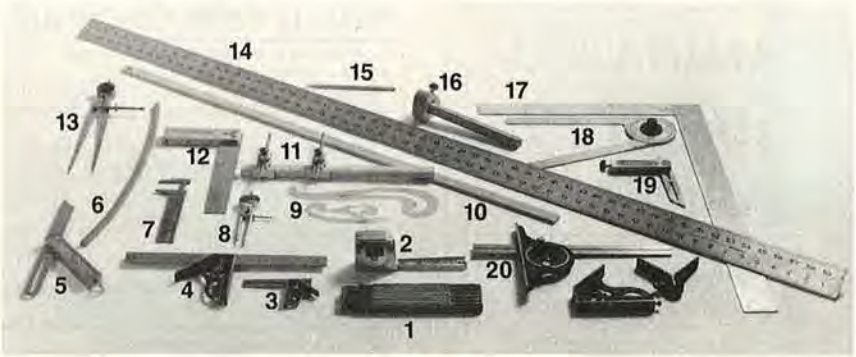
My *try square* (**12**) tests, or "tries," edges for squareness. The *dividers* (**13**) divide up or step off space—like small trammel points.

I know I couldn't do without the 5' *straightedge* (**14**) for all the layout I do on stock in the shop. Its reliability seems hardened into the steel. Just above it, a very special 4H lead *drafting pencil* (**15**) assures me of a thin, yet legible line. With the *marking gauge* (**16**), I can draw a line parallel to an edge.

The *framing square* (**17**) allows me to check the square of cabinet carcasses before fastening. When I want to find the miter point in an angle, I pick up the *angle finder* (**18**). For small workpieces, the 6" *sliding T-bevel* (**19**) works better than the larger one.

Mounted on a 12" rule, the sliding *compass head*, part of the set labeled (**20**), indicates angles from 0° to 359°. Just below it, the 45°/90° head verifies those respective angles. At its right, the *center finder* head locates the center of round stock.

To start with, I'd suggest this basic set: A 6' folding rule with slide extension; a 12' measuring tape; a 12" combination square; a sliding T-bevel; a compass/divider; and a framing square.



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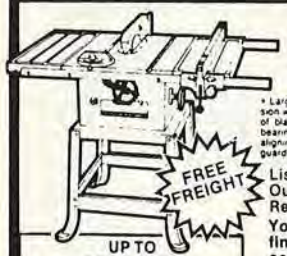

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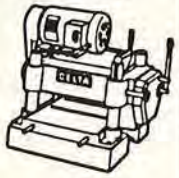

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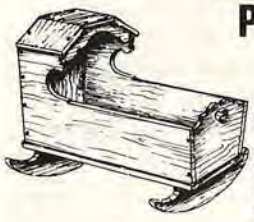

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SHOP SAFETY

10 DRILLING DOS AND DON'TS

Because they're sharp and spin so rapidly in the chuck, drill bits and boring devices demand caution during use. Follow these pointers for using them safely.

1. DO wear safety glasses to guard against eye injury, even when drilling softwoods.

2. DON'T touch bits or boring tools when they emerge from the hole—they can be hot.

3. DO clamp the workpiece down when boring large holes to prevent it from being thrown if the bit binds.

4. DON'T try to force the bit into the wood. It should be sharp enough to do the work alone.

5. DO make sure a good portion of the bit is firmly gripped in the chuck before you start drilling.

6. DON'T use your hand to brush away shavings from drilling metal—use a brush. The shavings are sharp *and* hot.

7. DO keep both hands away from the bit. Use a jig or clamp to hold small pieces securely.

8. DON'T use bits and boring tools meant exclusively for the drill press in a portable drill.

9. DO use scrapwood to back up the workpiece. It controls tearout, protects the table, and keeps bits from breaking off.

10. DON'T drill too fast! Use slow speeds for large bits and faster speeds for smaller bits. While you will have to take the wood you're drilling into consideration, here are some guidelines:

- Bits to ¼", drill at full speed
- Bits to ½", drill to 3,000 rpm
- Bits to 1", drill to 2,000 rpm
- Bits over 1", 300–500 rpm
- Reduce speed in metal, and use a lubricating oil while drilling.

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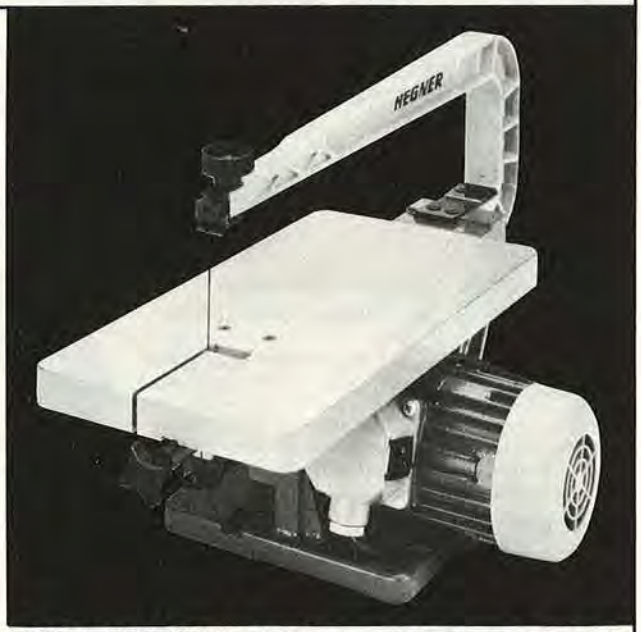

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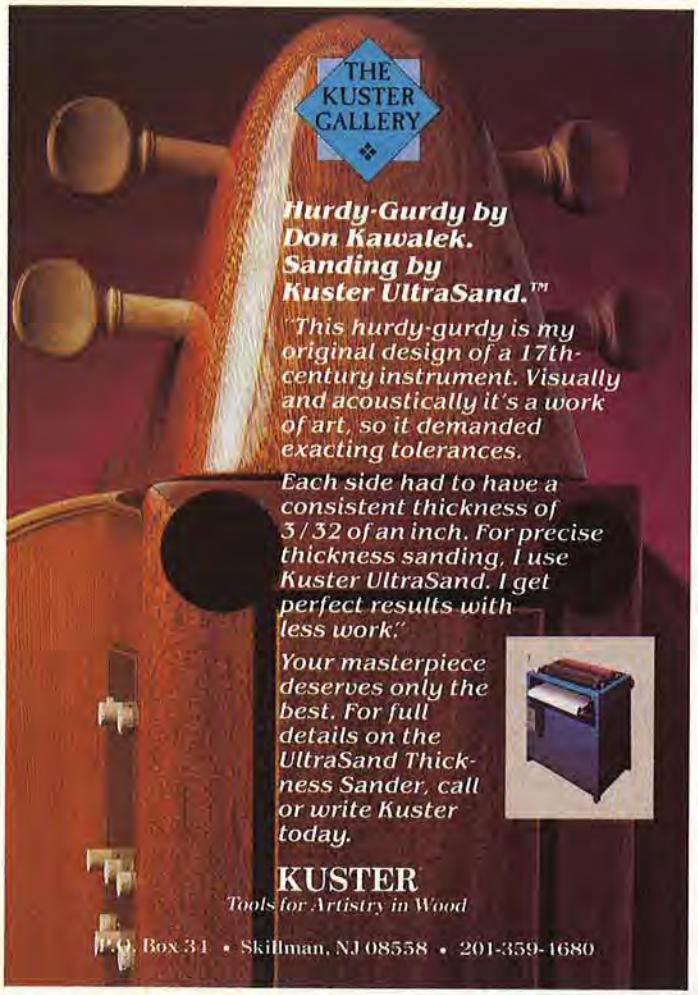
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If a foot-powered lathe or an old hollowing adze like the one in the logo, *above,* holds more interest for you than modern tools, you'll find grist for your mill with the Mid-West Tool Collectors Association (M-WTCA). Membership in the 18-year-old non-profit association puts you in touch with almost 1,800 enthusiasts who collect tools from the past. Although the group originated in the Midwest, its membership now includes collectors from every state.

M-WTCA members go about tool collecting seriously. They feel strongly about preserving as well as learning about old-time tools and the craftsmen who used them. Their association purpose, though, gives a clue to the spirit in which they band together: "to accomplish this in a spirit of fun and fellowship." This group of folks *enjoys* sharing their discoveries about tools from the past.

Oil cans, Stanley planes—you name it

Though some members collect a broad variety of tools, many collectors narrow their focus to a specific type of tool, product, or tools from only a specific period or location. A member from Missouri, for example, collects only oil cans. Another from North Carolina finds all the Stanley planes he can.

Association president Ray Nissen's greatest pleasure from membership comes each spring and fall as the Association meets to display, demonstrate, and swap their aged tools. Spread throughout a massive hall lie displays featuring practically every vintage tool imaginable—implements for woodworking, forging, farming, surgery, homemaking, and watchmaking, to name but a few. Attendance at these semiannual meetings is restricted to members. Anyone may join "at the door," however. Throughout the year, collectors gather at local or regional meetings for presentations or just to buy, sell, trade, and talk.

Facts galore in the *Gristmill*

News and information for members make the rounds through the association's quarterly magazine, the *Gristmill.* Detailed articles discuss such subjects as how Colonial watermills were erected or how saws were manufactured. Reprints of old hardware catalogs, advertisements, and articles circulate to give members more fodder for their collecting fires.

Annual membership is $12. For more information and a membership application, write *Morris Olson, Mid-West Tool Collectors Association, Dept. W, 2825 Jackson St., La Crosse, WI 54601.*

ASK WOOD

Whether your woodworker's license reads "Beginner," "Intermediate," or "Expert," you're bound to have a few questions about your favorite hobby. We can help. Each issue, we'll consult our experts for answers to your most-asked questions. Send your questions to:

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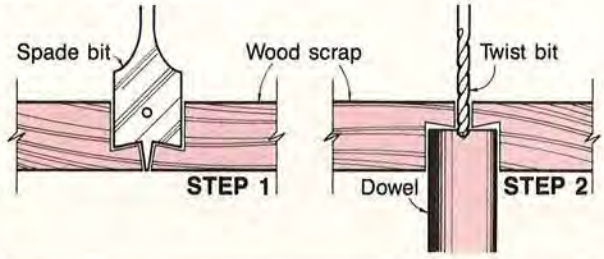
HOW TO FIND THE CENTER OF A DOWEL

Q. *How can I find the exact center of the end of a dowel for a project?*

—Anton Linn, Oakbrook, Ill.

A. Make a drilling jig from a scrap of lumber. Using a spade bit, start a hole in the wood that's the same size as the outside diameter of your dowel. Don't drill all the way through—stop as soon as the tip of the bit breaks through.

Then fit your dowel into the hole, flip the whole thing over, and use a standard twist bit to drill the end of the dowel.



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Q. *A couple of woodworkers I know swear by tung oil finishes. What's so good about them?*

—Clayton Lee, Cleveland, Ohio

A. Tung oil, which is derived from the seeds of Chinese tung trees, offers many advantages. A little goes a long way, so it's a good value for your money. Also, you don't have to be a pro to get a first-rate finish using it: All you do is rub on the tung oil with a rag, let it dry, buff with steel wool, and rub on another coat (or as many as necessary to get the finish you desire). In addition, it's just as easy to bring back a worn finish or repair a damaged area without stripping the whole surface or dealing with the "patched" look you'd get fixing other finishes. However, remember that tung oil does require periodic renewal to look its best.

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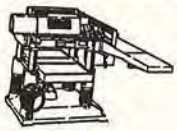

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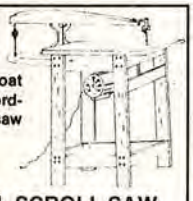

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ASK WOOD

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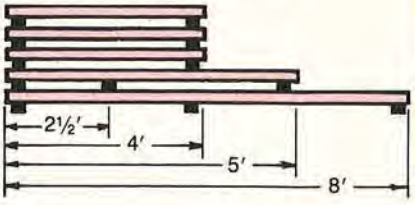
STICKER FOR DRY STORAGE

Q. *Should I sticker wood (i.e., separate stacked boards with small scraps for airflow) when I bring it home, or can I just stack it until I'm ready to use it?*

—Lois Anderson, Forest Beach, S.C.

A. Since air circulation is necessary to prevent moisture buildup (and warping), always sticker wood—dry or green—during storage. For green lumber, use sticker strips of the same species you're stacking. Otherwise, the color may leach from the stickers and stain your boards. (Once wood has dried, you can use plywood scraps for stickers.)

Position the stickers as close as possible to the ends of the boards to reduce checking. As they dry, the boards will tend to check or split from their ends to the stickers. Use one sticker under each end of boards 4′ long or shorter; add a sticker in the middle of 5–8′ runs. We use ¾×¾″ stickers cut long enough to go across the entire width of the board.



YES, YOU CAN TURN PLYWOOD

Q. *I've been unable to turn ¾″ plywood into a disk without causing splinters and gouges. What's the trick?*

—Harry Goldman, Glens Falls, N.Y.

A. Use the same turning speed you'd use for other projects, and keep your tools sharp. Because the glue lines you'll hit in the plywood are harder than the wood itself, you'll need to stop more often to hone the leading edges of your cutting tools.

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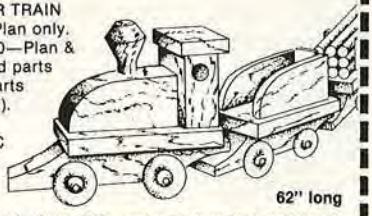

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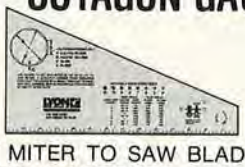

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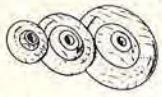

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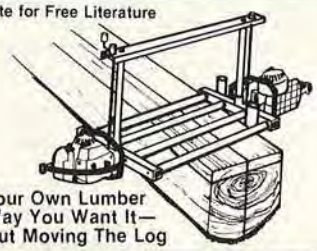

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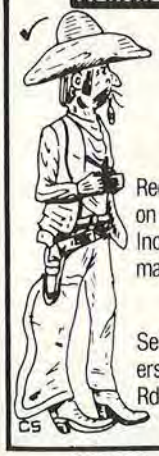

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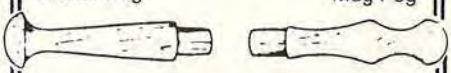

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Print this article

The Bulletin Board

FACTS, FACES & FABLES OF INTEREST TO HOME WOODWORKERS

WHAT'S A TREE WORTH? YOU'D BE SURPRISED!

To a lumber buyer, a defect-free walnut growing in prime conditions might be worth $800 or more, depending on its intended use (See "Timber Cruising," p. 50). But to Professor T. M. Das of the University of Calcutta, India, who studies environmental economics, that same tree has an economic value far greater than its lumber, wherever it grows.

Das reports that an ordinary tree is worth an amazing $196,250! Here's why: Based on that average tree's 50-year life span, it will generate $31,250 in oxygen, provide air pollution control equal to $62,500, stem erosion and enrich the soil to the tune of $31,250, play a $37,500 role in recycling water, and shelter wildlife at a value of another $31,250. All that, and the professor didn't even place a price tag on lumber, harvestable fruits and nuts, or aesthetic beauty.

FREE WOOD, YOURS FOR THE HAULING

Whether you realize it or not, each of us owns a piece of the national forests. And, provided you first receive permission from the U.S. Forest Service, you can take home a real piece of the forest.

To obtain small quantities of logs, stumps, and burls, first get details on the policy from your regional forester. For a listing of the national forests and the nine regional headquarters, write: *Edward H. Stone, Assistant Director of Recreation and Management, U.S. Dept. of Agriculture, Forest Service, P.O. Box 2417, Washington, DC 20013.*

AROUND THE NATION

The Woodworking Show, May 2–4.
Arlington Convention Center, Dallas, Tex. How-to workshops and technique seminars, new tools, project displays, and demonstrations.

Hands-On Woodworking Seminars. May 12–17.
Northern Illinois University, DeKalb, Ill. Two-day seminars offer intensive instruction by skilled woodworkers: Table saws, May 12–13; Routers, May 14–15; Finishing, May 16–17. Conducted by Roger Cliffe, Associate Professor, Industrial Technology. Each session, $200. For more information, write: Coordinator of Program Registration, College of Continuing Education, Adams Hall 131, Northern Illinois Univ., DeKalb, IL 60115. Phone 815-753-1458.

Wood Bending Techniques with William Keyser, May 17–18.
Center for Wood Design and Craftsmanship, The University of Akron, Akron, Ohio. Lecture and workshop skills. Advance registration required. Fee: $175. For details, call 216-384-2617.

Mid-Atlantic Woodworking Show, June 22–Aug. 24.
Stifel Fine Arts Center, Olgebay Institute, Wheeling, W.Va. Juried woodworking exhibition of furniture, toys, tools, sculpture, and musical instruments made by craftsman from five seaboard states.

FIRST LADY OF FINE WOODS: GERTRUDE M. CONSTANTINE

GERTRUDE M. CONSTANTINE

When Albert Constantine, Jr. married Gertrude Miller in 1926, Constantine & Company was in its 114th year. The Bronx, N.Y. company founded by Thomas Constantine in 1812 imported fine hardwoods and veneer for furniture and piano manufacturers.

Then, the stock market plummeted in the crash of 1929, and the Great Depression began to grip the nation. Mrs. Constantine saw her husband's dismay as the company's inventory stagnated. Yet, as she recalls, opportunity came knocking.

"People would drop by and ask to purchase small pieces of this wood or that veneer. It gave Albert the idea of selling directly to the hobbyist," she says. "We certainly had the wood, so he decided to sell it in quantities they wanted."

By placing a small ad, Albert founded their craft supply business, and turned the company in a new direction. "It began slowly," notes Mrs. Constantine, "but we have always been a source of woods from all over the world that couldn't be found anywhere else.

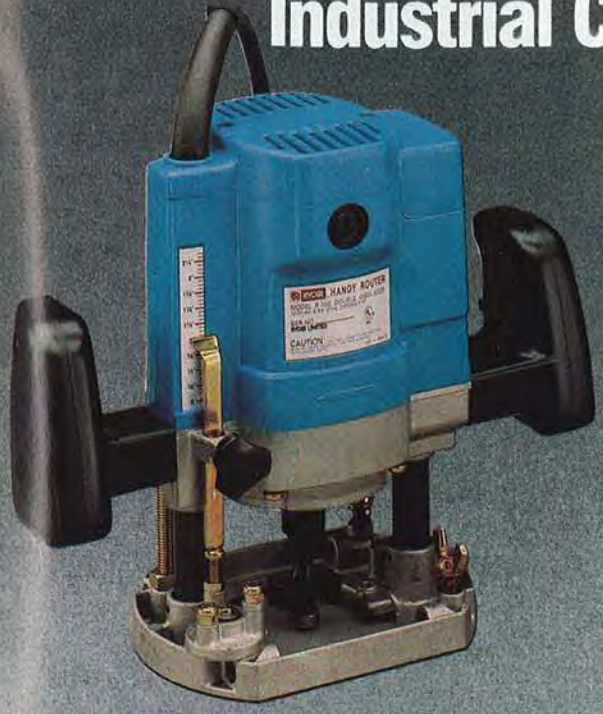
"I was learning about the business in those early growing years, and helping Albert by doing bookwork at home."

Now, Gertrude M. Constantine is chief executive officer of Albert Constantine & Son, Inc., widely acknowledged as the largest mail-order and retail supplier of fine woods for the hobbyist in the world. Albert Constantine, Jr., who died in 1967, left his wife a legacy, and a philosophy:

"Woodworking isn't a miracle. It's something everyone can do. Today, more than ever before, people realize that they don't have to be a professional woodworker to successfully work with wood. They're rediscovering wood."

Get a FREE Ryobi Router

and save $213.00 when you buy Freud's NEW Industrial Carbide Router Bit Set.



15 carbide bits and box jointed wooden case. (Purchased separately would cost you over $300.00)

Router Reg. $162.00, Router Bit Set $300.00 Value, Total Value $462.00

Yours for only $249.00

The Router Bit Set

Freud engineers have designed an industrial quality carbide router bit set at an affordable price. These precision tools are of the finest quality, and manufactured using only carbide or carbide-tipped bits. Carbide will last up to 50 times longer than steel bits before sharpening is required.

These bits exceed all requirements when cutting hard or soft woods, plastics or composition materials. In manufacturing, specific carbide grades are used to insure durable edges, and all bits are ground twice. This provides an extremely sharp mirror edge that cuts like no other on the market.

The Router

Ryobi (Model R-151) 1 Horsepower Plunge Router with new trigger switch on handle. Plunges 0 to 2 inches. It's light weight and compactness makes routing easy to handle. The plunge depth is set quickly by thumb action. The stop block can be adjusted for 3 different cutting levels. 24,000 RPM's. Double insulated. ¼" collet capacity. Comes complete with router bit adapter, template guide, straight guide and spanners.

90-100 Set consists of:

Item	Description	Cutting Length	Cutting Dia.	Radius (Bevel)	Depth of Cut	List Price
04-106	Solid Carbide Straight 2 Flute	¾	¼			11.05
04-140	Straight 2 Flute	¾	¾			15.60
16-100	Mortising	¾	½			12.73
18-104	Solid Carbide Round Nose	½	¼	⅛		17.64
20-104	"V" Grooving		½		½	21.15
22-104	Dovetail		½	(14°)	½	16.33
26-100	Panel Pilot	¾	¼			9.43
30-106	Cove			½	⅜	33.64
32-100	Rabbet	½			⅜	27.62
34-114	Rounding Over	With Bearing Guide		⅜		30.03
38-100	Roman Ogee	With Bearing Guide		5/32		32.90
40-106	Chamfer	1		(45°)		26.42
42-106	Flush Trim	½	½			15.62
64-100	Solid Carbide Flush Trim	⅜				7.64
66-100	Solid Carbide Bevel Trim	¼		(7°)		8.30

Box jointed wooden case, value $28.00

In California Call Toll Free: 1-800-824-0141

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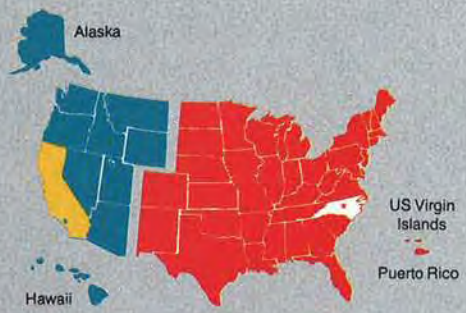

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From March 1st to May 31st, get a FREE jig saw with Ryobi's AP-10 Planer!

What an unbeatable pair — the new Plane Jane with our best jig saw, the electronic variable speed JSE-60!

Ryobi's Plane Jane has everything you want in a planer. Its lightweight (58 lbs.) and compact size (less than 2 ft. x 2 ft. x 2 ft.) make it practical for any workshop.

Yet it will plane material up to 10" wide and 5" thick. And Plane Jane's portability is a perfect match for contractors, who can take it to job sites as easily as they can a drill.

Find out why it's the hottest power tool to hit the market in years! And Ryobi has made the deal even sweeter by pairing Plane Jane with our super strong JSE-60 jig saw.

To take advantage of the offer, however, you must purchase Plane Jane between March 1st and May 31st. So look for it now!

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